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# Technical Specifications

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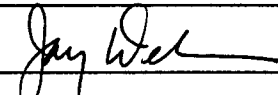


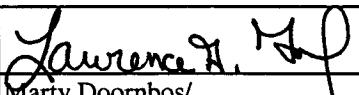
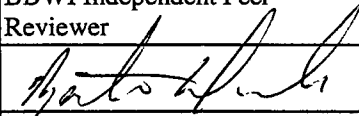
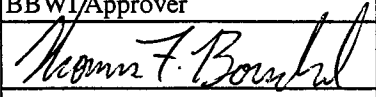
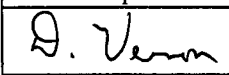
## ICDF Landfill and Evaporation Pond Remedial Design/Construction Work Plan – Title II

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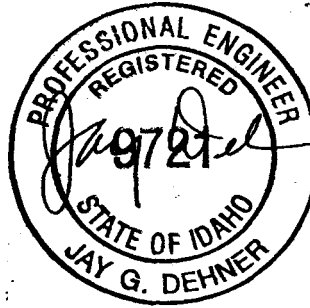
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**END OF SECTION**

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SECTION 02315--FILL AND BACKFILL

PART 1--GENERAL

WORK INCLUDED:

This section describes placement and testing of fill and backfill in general areas of the site (including stockpiles).

REFERENCES:

The following is a list of standards which may be referenced in this section:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D75	Standard Practice for Sampling Aggregates
ASTM D698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft <sup>3</sup> (600 kN-m/m <sup>3</sup> ))
ASTM D1140	Standard Test Method for Amount of Material in Soils Finer Than the No. 200 (75 micrometer) Sieve.

IDAHO TRANSPORTATION DEPARTMENT (ITD)

SSHC	Standard Specifications for Highway Construction, 1999
------	--

DEFINITIONS:

Relative Compaction:

Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D698.

Apply corrections for oversize material to maximum dry density.

Optimum Moisture Content: Determined in accordance with ASTM D698 specified to determine maximum dry density for relative compaction.

Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.

Completed Course: A course or layer that is ready for next layer or next phase of Work.

1 Lift: Loose (uncompacted) layer of material.

2  
3 Geosynthetics: Geotextiles, geocomposites, geosynthetic clay liner, or geomembranes.

4  
5 Well-Graded:

6  
7 A mixture of particle sizes with no specific concentration or lack thereof of one or more  
8 sizes.

9  
10 Does not define numerical value that must be placed on coefficient of uniformity, coefficient  
11 of curvature, or other specific grain size distribution parameters.

12  
13 Used to define material type that, when compacted, produces a strong and relatively  
14 incompressible soil mass free from detrimental voids.

15  
16 Influence Area: Area within planes sloped downward and outward at 60-degree angle from  
17 horizontal measured from:

18  
19 1-foot outside outermost edge at base of foundations or slabs.

20 1-foot outside outermost edge at surface of roadways or shoulder.

21 0.5-foot outside exterior at spring line of pipes or culverts.

22 Maximum depth of influence area shall be 2 feet.

23  
24 Selected Backfill Material: Materials available onsite suitable for specified use.

25  
26 Imported Material: Materials obtained from sources offsite, suitable for specified use.

27  
28 Standard Specifications: Idaho Transportation Department Standard Specifications for  
29 Highway Construction, 1999 edition. Parts of these Standard Specifications that are  
30 specifically referenced shall become a part of this section as though stated herein in full. In  
31 case of a discrepancy between the requirements of the Standard Specifications and the  
32 requirements stated herein, the requirements herein shall prevail.

33  
34 Permanent Stockpile: Stockpile of material that remains at the completion of construction.

35  
36 SEQUENCING AND SCHEDULING:

37  
38 Complete applicable Work specified in Sections 02316, EXCAVATION, and 02319,  
39 SUBGRADE PREPARATION, prior to placing fill or backfill.



1 PART 2--PRODUCTS

2  
3 EARTHFILL:

4  
5 Excavated material from required excavations and designated borrow sites, free from rocks  
6 larger than 6 inches in the greatest dimension, from roots and other organic matter, ashes,  
7 cinders, trash, debris, and other deleterious materials.

8  
9 Earthfill for berms only shall consist of excavated materials from required excavations and  
10 designated borrow sites, free from rocks larger than 6 inches in its greatest dimension, from  
11 roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.

12  
13 STRUCTURAL FILL:

14  
15 Well-graded structural material selected from the excavation, having a maximum particle  
16 size of 3 inches and a maximum of 10 percent by weight passing the No. 200 U.S. Standard  
17 sieve size.

18  
19 Selected material from the excavation meeting the specified requirements has been  
20 stockpiled in Temporary Stockpile Area.

21  
22 OPERATIONS LAYER 1 (LANDFILL):

23  
24 As specified for structural fill.

25  
26 OPERATIONS LAYER 2 (EVAPORATION POND AND SECONDARY LEAK  
27 DETECTION AND RECOVERY SYSTEM):

28  
29 As specified for structural fill, except that all material shall have a maximum particle size of  
30 2 inches and a maximum of 5 percent by weight passing the No. 200 U.S. Standard sieve  
31 size.

32  
33 DRAIN GRAVEL:

34  
35 As specified for structural fill except that material shall be screened to have a maximum  
36 particle size of 2 inches and maximum of 5 percent by weight passing the No. 10 U.S.  
37 Standard sieve size.

38  
39 BEDDING SAND:

40  
41 Screening material from processing of drain gravel is acceptable provided the following  
42 requirements are met: Gravelly sand with less than 12 percent passing No. 200 sieve, as  
43 determined in accordance with ASTM D1140. Maximum particle size shall be 1 inch.

1 CRUSHED GRAVEL BASE:

2  
3 Naturally or artificially graded mixture of 3/4-inch maximum size crushed gravel, crushed  
4 stone, natural and crushed sand. Material shall meet the requirements of Section 703.04  
5 (SSHC).

6  
7 BASE SOIL:

8  
9 As specified in Section 02660, SOIL BENTONITE LINER.

10  
11 WATER FOR MOISTURE CONDITIONING:

12  
13 Free of hazardous or toxic contaminants, or contaminants deleterious to proper compaction.  
14 Maximum allowable salt concentration shall be 35,000 mg/L.

15  
16 PART 3--EXECUTION

17  
18 GENERAL:

19  
20 Keep placement surfaces free of water, debris, and foreign material during placement and  
21 compaction of fill and backfill materials.

22  
23 Place and spread fill and backfill materials in horizontal lifts of uniform thickness as  
24 specified in paragraphs BACKFILL UNDER AND AROUND STRUCTURES and FILL, in  
25 a manner that avoids segregation, and compact each lift to specified densities prior to placing  
26 succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary  
27 to keep placement surfaces drained of water.

28  
29 Do not place fill or backfill, if fill or backfill material is frozen, or if surface upon which fill  
30 or backfill is to be placed is frozen.

31  
32 Tolerances:

33  
34 Final Lines and Grades: Within a tolerance of 0.1-foot unless dimensions or grades  
35 are shown or specified otherwise.

36  
37 Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not  
38 permitted.

39  
40 Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs,  
41 piping, and other facilities, caused by settlement of fill or backfill material.

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1 BACKFILL UNDER AND AROUND STRUCTURES:

2  
3 Under Facilities: Within influence area beneath future structures, slabs, pavements,  
4 roadways, and other facilities, backfill with structural fill, unless otherwise shown. Place  
5 structural fill in lifts of 6-inch maximum compacted thickness and compact each lift to  
6 minimum of 95 percent relative compaction as determined in accordance with ASTM D698.

7  
8 FILL:

9  
10 Outside Influence Areas Beneath Structures, Slabs, Piping, and Other Facilities: Unless  
11 otherwise shown, place earthfill as follows:

12  
13 Allow for 6-inch thickness of topsoil where required.

14  
15 Maximum 8-inch thick lifts.

16  
17 Place and compact fill across full width of embankment.

18  
19 Compact to minimum 95 percent relative compaction.

20  
21 REPLACING OVEREXCAVATED MATERIAL:

22  
23 Replace excavation carried below grade lines shown as follows:

24  
25 Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.

26  
27 Beneath Structures and Roadways: Structural fill.

28  
29 TOPSOIL:

30  
31 Place topsoil as specified in Section 02920, RECLAMATION AND REVEGETATION, on  
32 areas disturbed by construction and selected permanent stockpile slopes as shown on the  
33 Drawings.

34  
35 STOCKPILING:

36  
37 Material shall be placed in permanent stockpiles as follows:

38  
39 Place material in maximum 2-foot lifts and compact with a minimum four passes with  
40 earth-moving equipment.

41  
42 Maximum slopes shall be 4H:1V. Minimum slopes shall be 3 percent to promote  
43 drainage.

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Upper 2 feet of stockpile surface shall be placed in maximum 12-inch thick lifts and compacted to minimum 90 percent relative compaction as determined in accordance with ASTM D698.

Disturbed areas of selected permanent stockpiles shall be revegetated as specified in Section 02920, RECLAMATION AND REVEGETATION.

PLACING CRUSHED GRAVEL BASE:

As specified in Section 02772, ASPHALT CONCRETE PAVING.

PLACING DRAIN GRAVEL, OPERATIONS LAYER, AND DRAIN SAND OVER GEOSYNTHETICS:

Place material over geosynthetics as specified in Sections 02371, GEOTEXTILES; 02661, GEOMEMBRANES; and 02667, GEOSYNTHETIC CLAY LINER (GCL).

Place material to the lines and grades shown and compact by tracking a minimum three passes with spreading equipment.

BASE SOIL PLACEMENT AND COMPACTION:

As specified in Section 02666, SOIL BENTONITE LINER.

END OF SECTION 02315

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1 SECTION 02316--EXCAVATION

2  
3 PART 1--GENERAL

4  
5 WORK INCLUDED:

6  
7 This section describes all excavation necessary for completion of the Project, including  
8 excavation for structures, pipe trenches, and leachate sumps.  
9

10 REFERENCES:

11  
12 The following is a list of standards which may be referenced in this section:

13  
14 CODE OF FEDERAL REGULATIONS (CFR)

15  
16 29 CFR 1926 OSHA General Industry Safety Standards, Subpart P

17  
18 BECHTEL BWXT IDAHO, LLC PROGRAM REQUIREMENTS DOCUMENT

19  
20 PRD 2014 Excavations and Surface Penetrations

21  
22 EXCAVATION SAFETY:

23  
24 Excavation safety requirements shall be in accordance with 29 CFR 1926 Subpart P, and  
25 Program Requirements Document (PRD) 2014.

26  
27 Design, provide, and maintain shoring, sheeting, and bracing as necessary to support the  
28 sides of excavations and to prevent detrimental settlement and lateral movement of existing  
29 facilities, adjacent property, and completed Work. For excavations over 15 feet deep, a  
30 registered professional engineer licensed in the State of Idaho, shall design and inspect the  
31 excavation support system.  
32

33 WEATHER LIMITATIONS:

34  
35 Material excavated during inclement weather shall not be used as fill or backfill until after  
36 material drains and dries sufficiently for proper compaction.  
37

38 PART 2--PRODUCTS (NOT USED)

1 PART 3--EXECUTION

2  
3 GENERAL:

4  
5 Generally, excavate to lines, grades, and dimensions shown and as necessary to accomplish  
6 Work. Excavate to within tolerance of plus or minus 0.1 foot except where dimensions or  
7 grades are shown or specified as maximum or minimum.

8  
9 STRUCTURE EXCAVATION:

10  
11 Excavations for such structures as footings, foundations, slabs, and manholes shall be made  
12 to the depths shown on the drawings and of sufficient width to allow adequate room for  
13 setting and removing forms, installing accessories and inspection. Care shall be taken to  
14 prevent disturbing the bottom of the excavation. Excavation to final grade shall not be made  
15 until just before concrete forms are to be placed therein. Concrete foundations shall be placed  
16 only on undisturbed soil.

17  
18 TRENCH AND SUMP EXCAVATION:

19  
20 Trenches and sumps shall be of sufficient width to provide adequate room for workmen to  
21 perform any necessary service to the materials or items being installed therein and to permit  
22 proper compaction of the backfill.

23  
24 Minimum Width of Trenches: As shown on Drawings.

25  
26 Maximum Trench Width: Unlimited, unless otherwise shown or specified, or unless excess  
27 width will cause damage to existing facilities, adjacent property, or completed Work.

28  
29 If wet or otherwise unsatisfactory soil is encountered in a trench excavation, at or below the  
30 trench bottom, it shall be brought to the attention of the BBWI Construction Manager and  
31 removed as directed. The bottom of the excavation shall then be brought to the required  
32 grade with stabilization as specified in Section 02330, TRENCH BACKFILL.

33  
34 TEMPORARY STOCKPILE EXCAVATION:

35  
36 Always keep stockpile neat and orderly and work there in a systematic manner. Take  
37 necessary precautions to maintain existing erosion control measures and prevent offsite  
38 sediment releases.

39  
40 When work is completed in the stockpile area, grade area to drain surface water runoff to  
41 appropriate collection and discharge points. Reclaim disturbed areas of stockpile as specified  
42 in Sections 02315, FILL AND BACKFILL, and 02920, RECLAMATION AND  
43 REVEGETATION.

1 STOCKPILING EXCAVATED MATERIAL:

2  
3 Stockpile excavated material that is suitable for use as embankment or backfill, as operations  
4 material, road gravel, or leachate collection gravel, until material is needed. Place materials  
5 in stockpiles at the designated locations shown on the Drawings. Materials shall be placed in  
6 stockpiles as specified in Section 02315, FILL AND BACKFILL.

7  
8 Confine stockpiles to within approved work areas. Do not obstruct roads or streets.

9  
10 Do not stockpile excavated material adjacent to trenches and other excavations unless  
11 excavation sideslopes and excavation support systems are designed, constructed, and  
12 maintained for stockpile loads. The registered professional engineer responsible for the  
13 design shall approve stockpile locations.

14  
15 Do not stockpile excavated materials near or over existing facilities, adjacent property, or  
16 completed Work, if weight of stockpiled material could induce excessive settlement. The  
17 registered professional engineer responsible for the design shall approve stockpile locations.

18  
19 DISPOSAL OF SPOIL:

20  
21 Dispose of excavated materials, which are unsuitable or not needed for fill or backfill, in  
22 designated permanent stockpile areas shown on the Drawings, or spoil disposal areas as  
23 directed by BBWI's Construction Manager. Materials shall be placed as specified in  
24 Section 02315, FILL AND BACKFILL.

25  
26 TRENCH EXCAVATION FOR GEOSYNTHETIC ANCHOR TRENCHES:

27  
28 Geosynthetic anchor trench excavation shall be as specified in Section 02661,  
29 GEOMEMBRANES.

30  
31 END OF SECTION 02316

1 SECTION 02317--BORROW AREA EXCAVATION

2  
3 PART 1--GENERAL

4  
5 WORK INCLUDED:

6  
7 This section describes requirements for borrow excavation from the Rye Grass Flats Borrow  
8 Area as a source of base soil for the soil-bentonite admixture. The Rye Grass Flats Borrow  
9 Area is located within the INEEL boundary approximately 6 miles south of the ICDF site.

10  
11 REFERENCES:

12  
13 The following is a list of standards that may be referenced in this section:

14  
15 DEPARTMENT OF ENERGY (DOE)

16  
17 DOE/EA-1083 Environmental Assessment and Plan for New Silt/Clay Source  
18 Development and Use at the INEEL  
19

20 SEQUENCING AND SCHEDULING:

21  
22 Prepare site only after adequate erosion and sediment controls are in place. Minimize areas  
23 exposed uncontrolled to erosion during installation of temporary erosion and sediment  
24 controls.

25  
26 PART 2--PRODUCTS (NOT USED)

27  
28 PART 3--EXECUTION

29  
30 GENERAL:

31  
32 Clear, grub, and strip areas actually needed for borrow within limits shown or specified.

33  
34 Do not injure or deface vegetation that does not require removal.

35  
36 CLEARING:

37  
38 Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

39  
40 GRUBBING:

41  
42 Grub all areas where excavations, fill, roadways, structures, and ditches are to be placed.

43  
44 Vegetation included in clearing and grubbing shall be stockpiled with the strippings.

45



1 STRIPPING:

2  
3 Strip all areas where excavations are planned to remove organic materials. Do not remove  
4 subsoil with topsoil.

5  
6 Stockpile strippings, meeting requirements for topsoil in Section 02920, RECLAMATION  
7 AND REVEGETATION, separately from other excavated material.

8  
9 DISPOSAL:

10  
11 Clearing and Grubbing Debris: Debris that is not vegetation shall be hauled and disposed of  
12 at the Central Facilities Area (CFA) Landfill. Disposal of debris at the CFA landfill shall be  
13 coordinated with the BBWI Construction Manager. Bury vegetation that is not suitable for  
14 topsoil at a designated area as directed by BBWI's Construction Manager.

15  
16 Strippings: Dispose of strippings that are unsuitable for topsoil or that exceed project  
17 quantity required for topsoil as specified above for clearing and grubbing debris.

18  
19 BORROW AREA OPERATION:

20  
21 Borrow Area shall be developed and operated in accordance with the mitigation measures  
22 specified in DOE/EA-1083 and these Specifications. Mitigation and reclamation measures  
23 required by DOE/EA-1083 shall be reviewed and approved by the BBWI Construction  
24 Manager prior to Borrow Area development.

25  
26 Always keep borrow pits neat and orderly, and work them in systematic manner.  
27 Continuously keep borrow pits graded to drain to a low point, and take necessary precautions  
28 to control erosion and prevent offsite sediment releases as specified in DOE/EA-1083.  
29 Dewater as necessary to develop, operate, and reclaim each borrow area.

30  
31 Material meeting the requirements for base soil as specified in Section 02666, SOIL  
32 BENTONITE LINER, shall be excavated from the Borrow Area. Base soil should not be  
33 obtained below a depth of 8 feet below ground surface without evaluation of the material  
34 suitability and authorization from the BBWI Construction Manager.

35  
36 Do not excavate more borrow material than required for Work. Leave surplus material in  
37 place.

38  
39 Excavate material in an orderly manner to avoid inclusion of unacceptable material.

40  
41 RECLAMATION:

42  
43 At the completion of borrow area excavation, grade borrow pits to drain to low point so that  
44 ponded surface water may be removed by pumping. Where practical, blend graded surfaces

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neatly with surrounding terrain at completion of borrow operations. A minimum of 2 feet of soil shall be placed over bedrock to approximate the original contour.

Final Slopes:

Maximum: 4H:1V.

Minimum: 2 percent.

Do not use borrow pits for disposal, unless otherwise specified or shown.

Place topsoil and reestablish vegetation as specified in DOE/EA-1083 and Section 02920,  
RECLAMATION AND REVEGETATION.

END OF SECTION 02317

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1 PSECTION 02319--SUBGRADE PREPARATION

2  
3 PART 1--GENERAL

4  
5 WORK INCLUDED:

6  
7 This section describes requirements for preparation of subgrades in areas to receive fill.

8  
9 REFERENCES:

10  
11 The following is a list of standards which may be referenced in this section:

12  
13 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

14  
15 ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using  
16 Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))

17  
18 DEFINITIONS:

19  
20 Optimum Moisture Content: As defined in Section 02315, FILL AND BACKFILL.

21  
22 Prepared Ground Surface: Ground surface after completion of clearing and grubbing,  
23 scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of  
24 subgrade.

25  
26 Relative Compaction: As defined in Section 02315, FILL AND BACKFILL.

27  
28 Subgrade: Layer of existing soil after completion of excavation to grade prior to placement of  
29 fill, roadway structure or base for floor slab.

30  
31 SEQUENCING AND SCHEDULING:

32  
33 Complete applicable Work specified in Section 02316, EXCAVATION, prior to subgrade  
34 preparation.

35  
36 PART 2--PRODUCTS (NOT USED)

37  
38 PART 3--EXECUTION

39  
40 GENERAL:

41  
42 Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.

43  
44 Bring subgrade to proper grade and cross-section as shown on the Drawings, and uniformly  
45 compact surface.

Maintain prepared ground surface in finished condition until next course is placed.

**PREPARED SUBGRADE FOR ROADWAY, EMBANKMENT, AND STRUCTURES:**

After completion of excavation and prior to foundation, road fill, structural fill or embankment construction, compact prepared subgrade to 95 percent relative compaction. Scarify and moisture condition subgrade soil as required to achieve specified compaction. If soft or loose zones are found, correct as specified herein.

**PREPARED SUBGRADE FOR SOIL BENTONITE LINER AND BASE SOIL:**

Prior to soil bentonite liner or base soil placement, subgrade shall be backbladed to remove loose soil. Low spots or erosion rills shall be backfilled with structural fill as specified herein. Compact prepared subgrade to 95 percent relative compaction. Scarify and moisture condition subgrade soil as required to achieve specified compaction. If soft or loose zones are found, correct as specified herein.

**PREPARED SUBGRADE FOR SECONDARY AND TERTIARY GEOMEMBRANE (LANDFILL):**

After completion of landfill excavation and grading (tertiary) or soil bentonite liner placement (secondary), prepare the subgrade surface for geomembrane placement. The surface shall not have holes, depressions more than 1 inch in a 12-inch width, nor protrusions extending above the surface more than 1/2 inch. Roll surface with smooth-drum roller to form a firm stable base. Allow for leachate piping and sumps or features as shown on the Drawings.

**PREPARED SUBGRADE FOR PRIMARY GCL (EVAPORATION POND)**

After completion of operations layer and drain gravel placement, prepare the subgrade surface for GCL placement. The surface shall not have holes, depressions more than 1 inch in a 12-inch width, nor sharp, angular protrusions extending above the surface more than 1/2 inch. Roll surface with smooth-drum roller to form a firm stable base. The subgrade surface shall be free of standing water or excessive moisture.

**PREPARED SUBGRADE FOR SECONDARY GCL (EVAPORATION POND)**

After completion of base soil placement, prepare the subgrade surface for GCL placement. The surface shall not have holes, depressions more than 1 inch in a 12-inch width, nor protrusions extending above the surface more than 1/2 inch. Roll surface with smooth-drum roller to form a firm stable base. The subgrade surface shall be free of standing water or excessive moisture.

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1 CORRECTION:

2  
3 Soft or Loose Subgrade:

4  
5 Adjust moisture content and compact to meet density requirements, or

6  
7 Over excavate and replace with suitable material from the excavation, as specified in  
8 Section 02315, FILL AND BACKFILL.

9  
10 Unsuitable Material: Over excavate and replace with suitable material from the excavation,  
11 as specified in Section 02315, FILL AND BACKFILL. Dispose of unsuitable material  
12 excavation in accordance with Article DISPOSAL OF SOIL in Section 02316,  
13 EXCAVATION.

14  
15 END OF SECTION 02319

SECTION 02320--TRENCH BACKFILL

PART 1--GENERAL

WORK INCLUDED:

This section describes requirements for backfilling of pipe and conduit trenches.

REFERENCES:

The following is a list of standards which may be referenced in this section:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D698	Test Method for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft-lbf/ft <sup>3</sup> (600 kN-m/m <sup>3</sup> )).
ASTM D1140	Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve.
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

DEFINITIONS:

Pipe Bedding: Granular material upon which pipes, conduits, cables, or duct banks are placed.

Imported Material: Material obtained by the Construction Subcontractor from source(s) offsite.

Lift: Loose (uncompacted) layer of material.

Pipe Zone: Backfill zone that includes full trench width and extends from prepared trench bottom to an upper limit above top outside surface of pipe, conduit, cable or duct bank.

Prepared Trench Bottom: Graded trench bottom after stabilization and installation of bedding material.

Relative Compaction: The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by ASTM D698. Corrections for oversize material may be applied to either the as-compacted field dry density or the maximum dry density.

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1 PART 2--PRODUCTS

2  
3 LOCATOR RIBBON:

4  
5 Ribbon shall be 3 inches wide and shall be red for all electrical conduits, electrical cables,  
6 and telephone cables. Yellow ribbon shall be used for all buried pipelines.

7  
8 Ribbon shall be tape manufactured by Reef Industries or Allen Markline or equal and shall  
9 have metal foil which is completely encased in plastic and can be easily detected by metal  
10 detectors.

11  
12 The ribbon shall be printed with the manufacturer's standard wording, "CAUTION  
13 ELECTRIC LINE BURIED BELOW," for all electrical conduits, phone lines, etc.,  
14 "CAUTION BURIED PIPELINE BELOW," for all buried pipelines.

15 TRENCH STABILIZATION MATERIAL:

16  
17 Granular material from the excavation or stockpile meeting the requirements of structural fill  
18 as specified in Section 02315, FILL AND BACKFILL.

19  
20 BEDDING MATERIAL AND PIPE ZONE MATERIAL:

21  
22 Unfrozen, friable, and no clay balls, roots, or other organic material.

23  
24 Screening material from processing of drain gravel is acceptable provided the following  
25 requirements are met: Gravelly sand with less than 12 percent passing No. 200 sieve, as  
26 determined in accordance with ASTM D1140, or gravel or crushed rock within maximum  
27 particle size and other requirements as follows unless otherwise specified.

28  
29 Duct Banks: 3/4-inch maximum particle size.

30  
31 PVC Piping: 3/8-inch maximum particle size.

32  
33 Pipe Under 18 Inches Diameter: 3/4-inch maximum particle size, except 1/4 inch for  
34 stainless steel pipe, copper pipe and tubing.

35  
36 Pipe Greater than 18 Inches Diameter: 1-1/2-inch maximum particle size for ductile  
37 iron pipe, concrete pipe, welded steel pipe, and pretensioned or prestressed concrete  
38 cylinder pipe.

39  
40 EARTH BACKFILL:

41  
42 Earthfill as specified in Section 02315, FILL AND BACKFILL.

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1 STRUCTURAL FILL:

2  
3 As specified in Section 02315, FILL AND BACKFILL.

4  
5 PART 3--EXECUTION

6  
7 TRENCH PREPARATION:

8  
9 Water Control:

10  
11 Promptly remove and dispose of water entering trench as necessary to grade trench  
12 bottom and to compact backfill and install manholes, pipe, conduit, direct-buried  
13 cable, or duct bank. Do not place concrete, lay pipe, conduit, direct-buried cable, or  
14 duct bank in water.

15  
16 Remove water in a manner that minimizes soil erosion from trench sides and bottom.

17  
18 Provide continuous water control until trench backfill is complete.

19  
20 Remove foreign material and backfill contaminated with foreign material that falls into  
21 trench.

22  
23 TRENCH BOTTOM:

24  
25 Firm Subgrade: Grade with hand tools, remove loose and disturbed material, and trim off  
26 high areas and ridges left by excavating bucket teeth. Allow space for bedding material if  
27 shown or specified.

28  
29 Soft Subgrade: If subgrade is encountered that may require removal to prevent pipe  
30 settlement, notify BBWI Construction Manager. BBWI Construction Manager will determine  
31 depth of overexcavation, if any, required.

32  
33 TRENCH STABILIZATION MATERIAL INSTALLATION:

34  
35 Rebuild trench bottom with trench stabilization material.

36  
37 Place material over full width of trench in 8-inch maximum, loose measurement lifts to  
38 required grade, providing allowance for bedding thickness.

39  
40 Compact each lift so as to provide a firm, unyielding support for the bedding material prior to  
41 placing succeeding lifts.



1 BEDDING:

2  
3 Place over the full width of the prepared trench bottom in two equal lifts when the required  
4 depth exceeds 8 inches.

5  
6 Hand grade and compact each lift to provide a firm, unyielding surface.

7  
8 Minimum Compacted Thickness: As shown on the Drawings. For perforated leachate  
9 collection pipe, there shall be no bedding between lining system and pipe.

10  
11 Direct-Buried Cable: 3 inches.

12  
13 Duct Banks: 2 inches.

14  
15 Check grade and correct irregularities in bedding material.

16  
17 BACKFILL PIPE ZONE:

18  
19 Upper limit of pipe zone shall not be less than following:

20  
21 Pipe: 12 inches, unless shown otherwise.

22  
23 Conduit: 3 inches, unless shown otherwise.

24  
25 Direct-Buried Cable: 3 inches, unless shown otherwise.

26  
27 Duct Bank: 3 inches, unless shown otherwise.

28  
29 Restrain pipe, conduit, cables, and duct banks as necessary to prevent their movement during  
30 backfill operations.

31  
32 Place pipe zone material simultaneously in lifts on both sides of pipe and, if applicable,  
33 between pipes, conduit, cables, and duct banks installed in same trench.

34  
35 Pipes 10 Inches and Smaller Diameter: First lift less than or equal to 1/2 pipe-  
36 diameter.

37  
38 Pipes Over 10-Inch Diameter: Maximum 8-inch, loose measurement lifts.

39  
40 Thoroughly tamp each lift, including area under haunches, with handheld tamping bars  
41 supplemented by “walking in” and slicing material under haunches with a shovel to ensure  
42 that voids are completely filled before placing each succeeding lift.

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After the full depth of the pipe zone material has been placed as specified, compact the material by a minimum of three passes with a vibratory plate compactor only over the area between the sides of the pipe and the trench walls.

Do not use power-driven impact compactors to compact pipe zone material.

#### LOCATOR RIBBON INSTALLATION:

Continuously install locator ribbon along centerline of all buried piping, at depth of 16 inches below ground surface unless shown otherwise on the Drawings. Coordinate with piping installation drawings.

#### BACKFILL ABOVE PIPE ZONE:

##### General:

Do not allow backfill to free fall into the trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over the top of pipe.

Do not use power driven impact type compactors for compaction until at least 2 feet of backfill is placed over top of pipe.

Backfill to grade with proper allowances for topsoil, road gravel subbase, and pavement thicknesses, wherever applicable.

Backfill around structures with same backfill as specified for adjacent trench unless otherwise shown or specified.

##### Backfill Outside the Limits of Roadways, Utilities, and Other Facilities:

Place earthfill in lifts not exceeding 12-inch maximum, loose measurement thickness.

Mechanically compact each lift to a minimum of 90 percent relative compaction prior to placing succeeding lifts.

Backfill Under Facilities, Roadways, and Utilities: Backfill trench above the pipe zone with structural fill in lifts not exceeding 8 inches maximum, loose measurement thickness. Compact each lift to a minimum of 95 percent relative compaction prior to placing succeeding lifts.

#### REPLACEMENT OF TOPSOIL:

Where applicable, replace topsoil in top 6 inches of backfilled trench.

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Maintain the finished grade of topsoil even with adjacent area and grade as necessary to restore drainage.

**BACKFILL FOR LEACHATE COLLECTION (SLOTTED) PIPE:**

Use drain gravel as specified in Section 02315, FILL AND BACKFILL. Place simultaneously on both sides of pipe in 6-inch lifts. Work the material around the lower part of the pipe to ensure solid backing to underside of pipe and fittings.

**BACKFILL FOR GEOSYNTHETIC ANCHOR TRENCHES:**

Backfill with material as shown on the Drawings in loose lifts not exceeding 6 inches in thickness and compact using hand-operated equipment to not less than 90 percent relative compaction.

**MAINTENANCE OF TRENCH BACKFILL:**

After each section of trench is backfilled, maintain the surface of the backfilled trench even with the adjacent ground surface until final surface restoration is completed.

Topsoil: Add topsoil where applicable and as necessary to maintain the surface of the backfilled trench level with the adjacent ground surface.

Other Areas: Add excavated material where applicable and keep the surface of the backfilled trench level with the adjacent ground surface.

**SETTLEMENT OF BACKFILL:**

Settlement of trench backfill, or of fill or facilities constructed over trench backfill will be considered a result of defective compaction of trench backfill.

END OF SECTION 02320

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SECTION 02371--GEOTEXTILES

PART 1--GENERAL

REFERENCES:

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

ASTM D3776	Standard Test Method for Mass Per Unit Area (Weight) of Fabric.
ASTM D4355	Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
ASTM D4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
ASTM D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D4751	Standard Test Method for Determining Apparent Opening Size.
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
ASTM D5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

DESCRIPTION:

The Work includes manufacture, fabrication (if needed), supply, and installation of geotextiles associated with the lining of waste disposal facility and evaporation pond, and other applications as shown on the Drawings. This section also applies to geotextiles used in geocomposite drainage layers [see Section 02373, COMPOSITE DRAINAGE NET (GEOCOMPOSITE)].

PART 2--PRODUCTS

GENERAL:

Types of Geotextiles:

Type 1 (separation) geotextile shall be 6 oz/yd<sup>2</sup> nominal weight and shall be used for separation of soil layers, in the geocomposite drainage layers, and at other locations as shown on the Drawings.

Type 2 (cushion) geotextile shall be 12 oz/yd<sup>2</sup> nominal weight and shall be used for cushioning of geomembranes and at other locations as shown on the Drawings.

All geotextiles, regardless of type, shall be nonwoven, needlepunched polypropylene.

Manufacturer: The geotextile manufacturer shall be a commercial entity normally engaged in manufacture of geotextiles for landfill applications.

#### REQUIRED PROPERTIES:

##### Property Values:

Geotextile properties shall meet or exceed the values specified in Table 1, Required Geotextile Properties, contained in this section of the Specifications (Type 1 and Type 2 geotextiles only).

The manufacturer shall provide test results for all properties listed in Table 1 (Type 1 and Type 2 geotextiles only).

The manufacturer shall certify that the materials supplied meet the requirements of this Part (Type 1 and Type 2 geotextiles only).

Roadway construction geotextile shall meet or exceed the property values listed on the manufacturer's standard commercial data sheet. The manufacturer shall submit test data on the lot(s) supplied for this Project to demonstrate compliance with published specifications.

Integrity: Geotextiles shall retain their structure during handling, placement, and long-term service.

#### TRANSPORTATION, HANDLING, AND STORAGE:

Geotextiles shall be supplied in rolls wrapped in covers and marked or tagged with the roll number. Each material roll shall include information to demonstrate material traceability through written documentation from the manufacturer and transport company. At a minimum this information shall include the Manufacturer's Name, Product Identification, Lot Number and Roll Dimension (Area and Width).

Transportation of the geotextiles to the site and all handling on site shall be the responsibility of the Construction Subcontractor.

During shipment and storage, the geotextile shall be protected from mud, dirt, UV exposure, dust, puncture, cutting, or other damaging or deleterious conditions. Protective wrappings which are damaged shall be repaired or replaced, as necessary.

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The Construction Subcontractor shall be responsible for the storage of the geotextiles on site within the areas shown on the Drawings. The Construction Subcontractor shall protect storage area(s) from theft, vandalism, passage of vehicles, etc.

### PART 3--EXECUTION

#### GENERAL:

Unacceptable Materials and Work: Materials and Work which fail to meet the requirements of these Specifications shall be removed and disposed of at the Construction Subcontractor's expense. This includes geotextile rolls that are not labeled or where the label has deteriorated to the point of being illegible.

#### HANDLING AND PLACEMENT:

The Construction Subcontractor shall handle all geotextiles in such a manner as to ensure that they are not damaged. Do not drag the geotextile across textured geomembrane. If necessary, use a smooth slip sheet under the textile. Position the geotextile after deployment and remove the slip sheet, if used.

Place geotextiles in a manner that prevents folds and wrinkles. Folds or wrinkles shall be pulled smooth prior to seaming.

In the presence of wind, all exposed geotextiles shall be weighted with sandbags or equivalent. Sandbags shall be installed during placement and shall remain until replaced with cover material.

Geotextiles shall be cut using an approved geotextile cutter only. Special care shall be taken to protect underlying geosynthetic materials from damage during cutting.

During geotextile placement, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the geomembrane, clog drains or filters, or hamper subsequent seaming.

Geotextiles shall be placed with the machine direction (long dimension) downslope or normal to the natural slope.

After installation and immediately prior to placing overlying materials, the geotextile shall be examined over its entire surface to ensure that no potentially harmful foreign objects, such as needles, are present. Any foreign objects encountered shall be removed, or the geotextile shall be replaced.

If light colored geotextile is used, precautions shall be taken against "snowblindness" of personnel.

After deployment, all geotextile shall be covered to prevent exposure to ultraviolet (UV) radiation (sunlight) within a maximum period of 14 days. If the geotextile is exposed for more than 14 days, a temporary cover may be deployed for the duration of the delay or samples may be submitted to an independent testing laboratory to ensure that detrimental levels of UV degradation have not occurred. Detrimental level of UV degradation is defined as greater than 10 percent loss of required geotextile properties listed in Table 1 for the following:

- (a) Grab strength.
- (b) Trapezoidal tear strength.
- (c) Puncture strength.

#### JOINTS:

Edge of roll seams are not required to be sewn and shall be overlapped a minimum of 6 inches. End of roll seams are not required to be sewn and shall be overlapped a minimum of 12 inches. No end-of-roll seams shall be allowed on slopes 6H:1V and steeper. Overlaps shall be in the direction of flow with the upstream fabric on top of the downstream fabric.

On the landfill floor, no horizontal seam shall be closer than 3 feet to the toe of the slope or other areas of potential stress concentrations.

Areas to be seamed shall be clean and free of foreign material.

#### REPAIR:

Any holes or tears in the geotextile shall be repaired as follows:

Remove any soil or other material which may have penetrated the torn geotextile.

Replace torn areas and holes by placing a geotextile patch having dimensions of at least 12 inches greater than the tear or hole. The geotextile patch shall be sewn.

#### MATERIALS IN CONTACT WITH GEOTEXTILES:

The Construction Subcontractor shall place all soil materials located on top of a geotextile in such a manner as to ensure that the following conditions are satisfied:

No damage to the geotextile.

Minimal slippage of the geotextile on underlying layers.

No excess tensile stresses in the geotextile.

END OF SECTION 02371

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Table 1. REQUIRED GEOTEXTILE PROPERTIES

<u>Property</u>	<u>Unit</u>	<u>Value</u> <sup>(a)</sup>		<u>Test Method</u>
		<u>Type 1</u>	<u>Type 2</u>	
Mass/Unit Area	oz/yd <sup>2</sup>	6.0 <sup>(b)</sup>	12.0 <sup>(b)</sup>	ASTM D5261 or D3776
Apparent Opening Size <sup>(b)</sup>	U.S. Sieve	70 max opening 100 min opening	—	ASTM D4751
Grab Strength	lb	140	300	ASTM D4632
Trapezoidal Tear Strength	lb	70	110	ASTM D4533
Puncture Strength	lb	70	135	ASTM D4833
Flow Rate	gpm/ft <sup>2</sup>	100	—	ASTM D4491
UV Resistance (500 hours)	% strength retained	70	70	ASTM D4355

Notes:

<sup>(a)</sup> All values are minimum average values, except as noted.

<sup>(b)</sup> Nominal values.



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SECTION 02373--COMPOSITE DRAINAGE NET (GEOCOMPOSITE)

PART 1--GENERAL

REFERENCES:

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D413	Standard Test Method for Rubber Property Adhesion to Flexible Substrate
ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique.
ASTM D1603	Standard Test Method for Carbon Black in Olefin Plastics.
ASTM D1777	Standard Test Method for Measuring Thickness of Textile Materials.
ASTM D4218	Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
ASTM D4716	Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.
ASTM D5199	Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.

GEOSYNTHETIC RESEARCH INSTITUTE (GRI)

GRI-GC7	Determination of Adhesion and Bond Strength of Geocomposites
---------	--

DESCRIPTION:

The Work includes manufacture, fabrication (if needed), supply, and installation of composite drainage net (geocomposite) drainage layers associated with the lining of waste disposal facility. The geocomposite shall consist of a layer of geotextile thermally bonded to each side of a geonet. Requirements for geotextiles are contained in Section 02371, GEOTEXTILES, of these Specifications. Requirements for geonets and the finished geocomposite are contained in this section.

PART 2--PRODUCTS

GENERAL:

Manufacturer: Geocomposite shall be FabriNet® as manufactured by GSE Lining Technology, Inc., Houston, TX.

1 Composition:

2  
3 The geonet shall be high density polyethylene (HDPE).

4  
5 The geocomposite shall consist of Type 1 geotextile, as specified in Section 02731,  
6 GEOTEXTILES, thermally bonded to each side of the HDPE geonet.

7  
8 REQUIRED PROPERTIES:

9  
10 Property Values:

11  
12 Geonet: Geonet properties shall meet or exceed the values specified in the table of  
13 required geonet properties contained in this section of the Specifications.

14  
15 Geotextile: Geotextile properties shall meet or exceed the values specified in  
16 Section 02371, GEOTEXTILES, of these Specifications.

17  
18 Finished Geocomposite: Geocomposite properties shall meet or exceed the values  
19 specified in the table of required geocomposite properties contained in this section of  
20 the Specifications.

21  
22 Manufacturer's Information: The manufacturer shall provide specification sheets,  
23 literature, and test results for all properties listed in these Specifications. The  
24 manufacturer shall certify that the materials supplied meet the requirements of this  
25 Part.

26  
27 Integrity: Geocomposites shall retain their structure during handling, placement, and long-  
28 term service.

29  
30 TRANSPORTATION, HANDLING, AND STORAGE:

31  
32 Geonets and Geocomposites shall be supplied in rolls wrapped in covers and marked or  
33 tagged with the roll number. Each material roll shall include information to demonstrate  
34 material traceability through written documentation from the manufacturer and transport  
35 company. At a minimum this information shall include the Manufacturer's Name, Product  
36 Identification, Lot Number and Roll Dimension (Area and Width).

37  
38 Transportation of the geocomposite to the site and all handling on site will be the  
39 responsibility of the Construction Subcontractor.

40  
41 During shipment and storage, the geonet and geocomposite shall be protected from mud, dirt,  
42 UV exposure, dust, puncture, cutting, or other damaging or deleterious conditions. Protective  
43 wrappings which are damaged shall be repaired or replaced, as necessary.

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The Construction Subcontractor shall be responsible for the storage of the geocomposite on site within the limits of construction. The Construction Subcontractor shall protect storage area(s) from theft, vandalism, passage of vehicles, etc.

### PART 3--EXECUTION

#### GENERAL:

Unacceptable Materials and Work: Materials and Work which fail to meet the requirements of these Specifications shall be removed, disposed of, and replaced at the Construction Subcontractor's expense.

#### HANDLING AND PLACEMENT:

The Construction Subcontractor shall handle all geocomposites in such a manner as to ensure that these materials are not damaged.

Clean geomembrane surface prior to placing geocomposite.

On slopes, geocomposite may be deployed over slip sheets with the roll at the top of the slope. An alternative method is to secure the geocomposite and then roll it down slope in a manner to continually keep it in tension. If necessary, position the geocomposite after deployment to minimize wrinkles and remove the slip sheet, if used.

Do not drag the geocomposite across textured geomembrane.

In the presence of wind, all exposed geocomposites shall be weighted with sandbags or equivalent. Sandbags shall be installed during geocomposite placement and shall remain until replaced with cover material.

Unless otherwise specified, geocomposites shall not be welded to geomembranes.

Geocomposites shall only be cut using approved cutting tools. Protect underlying geosynthetics when cutting.

The Construction Subcontractor shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.

During placement of geocomposites, care shall be taken not to entrap dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geomembrane. Dirt or excessive dust entrapped in the geocomposite shall be cleaned prior to placement of the next material on top of it. Excessive dust is defined as any thickness greater than 20 mils (0.02 inch) within the geonet core of the geocomposite. In this regard, care shall be taken with the handling of sandbags, to prevent rupture or damage of the sandbag.

Tools shall not be left in the geocomposite.

In geocomposites, tearing the geotextile away from the geonet shall not be allowed except at seam locations in corners. Tearing of the geotextile away from the geonet in these locations shall be minimized to the extent necessary to perform the required work.

#### JOINING:

Geocomposite panels shall be overlapped and tied side to side and end to end as recommended by the manufacturer. Acceptable tying devices include strings, plastic fasteners, or polymer braid. Tying devices shall be of contrasting color to the geocomposite for easy observation. Metallic devices are not allowed.

No horizontal seams shall be allowed on side slopes except at roll ends.

If more than one layer of geocomposite is installed, joints shall be staggered.

#### REPAIR:

Remove the damaged area of geocomposite.

Cut a piece of geonet to fit into the repair area. Geonet shall fit into repair area to form a flush surface with the geocomposite. Cut geonet so that ribs are in the same orientation as existing geocomposite.

Remove any dirt or other foreign material which may have entered the geocomposite.

Place geonet patch into repair area.

Place Type 1 geotextile over the geonet patch. Cut geotextile to overlap existing geocomposite at least 150 mm (6 inches) in all directions. Heat seam geotextile to geocomposite around its entire perimeter.

#### MATERIALS IN CONTACT WITH GEOCOMPOSITES:

The Construction Subcontractor shall place all soil materials located on top of a geocomposite layer in such a manner as to ensure that the following conditions are satisfied:

No damage to the geocomposite.

No slippage of the geocomposite on underlying layers.

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- 1 No excess tensile stresses in the geocomposite.
- 2
- 3 END OF SECTION 02373

Table 1. REQUIRED GEONET PROPERTIES

<u>Property</u>	<u>Qualifier</u>	<u>Unit</u>	<u>Value</u>	<u>Test</u>
Polymer Composition	Minimum	% polyethylene	95	---
Resin Specific Gravity	minimum	N/A	0.92	ASTM D1505
Carbon Black Content	range	%	2 - 3	ASTM D1603 or D4218
Thickness	MARV	mils	200	ASTM D1777 or D5199

Table 2. REQUIRED GEOCOMPOSITE PROPERTIES

<u>Property</u>	<u>Qualifier</u>	<u>Unit</u>	<u>Value</u>	<u>Test</u>
Ply Adhesion	ARV	lb/in	1.0	ASTM D413 or GRI-GC7
Transmissivity <sup>(1)</sup>	MARV	m <sup>2</sup> /sec	3 x 10 <sup>-4(2)</sup>	ASTM D4716
	MARV	m <sup>2</sup> /sec	3 x 10 <sup>-5(3)</sup>	ASTM D4716

Notes:

MARV = Minimum Average Roll Value.

ARV = Average Roll Value.

<sup>(1)</sup>The design transmissivity is the hydraulic transmissivity of the geocomposite measured using water at 68 degrees F ±3 degrees F with a hydraulic gradient of 0.5, under the compressive stress shown for each required transmissivity value. Transmissivity value shall be measured between two steel plates 15 minutes after application of the confining stress in the machine direction.

<sup>(2)</sup>Under a compressive stress of 1,000 psf.

<sup>(3)</sup>Under a compressive stress of 10,000 psf.

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SECTION 02444--CHAIN LINK FENCING

PART 1--GENERAL

REFERENCES:

The following is a list of standards which may be referenced in this section:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A90	Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles With Zinc or Zinc-Alloy Coatings
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A824	Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain Link Fence
ASTM F552	Standard Terminology Relating to Chain Link Fencing
ASTM F567	Standard Practice for Installation of Chain-Link Fence
ASTM F626	Standard Specification for Fence Fittings
ASTM F900	Standard Specification for Industrial and Commercial Swing Gates
ASTM F1043	Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
ASTM F1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F1184	Standard Specification for Industrial and Commercial Horizontal Slide Gates

DEPARTMENT OF ENERGY (DOE)

DOE-ID-AES 1639 Grounding

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 780 Standard for Installation of Lightning Protection Systems

DEFINITIONS:

Terms as defined in ASTM F552.

Standard Details: Typical DOE-ID design details attached as a supplement to this section.

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1 SCHEDULING AND SEQUENCING:

2  
3 Complete necessary site preparation and grading before installing chain link fence and gates.

4  
5 PART 2--PRODUCTS

6  
7 GENERAL:

8  
9 Match style, finish, and color of each fence component with that of other fence components.

10  
11 CHAIN LINK FENCE FABRIC:

12  
13 Metal fence fabric shall be No. 9 gage wire woven into a 2-inch mesh. Fabric finish shall be  
14 hot-dipped zinc galvanized per ASTM A392. Finish shall provide not less than 1.2 ounces of  
15 zinc per square foot of fabric when tested in accordance with ASTM A90.

16  
17 POSTS, RAILS, AND BRACES:

18  
19 Posts, rails, and braces shall be hot dipped galvanized with a minimum average zinc coating  
20 of 1.8-ounces per square foot meeting ASTM F1083 and ASTM F1043 for standard  
21 (Schedule 40) galvanized pipe.

22  
23 Line posts shall be 1.90 inches O.D. by 2.28 pounds per foot. Corner and pull posts shall be  
24 4.5 inches O.D. by 10.79 pounds per foot.

25  
26 Bracing shall be 1.66 inches O.D. by 2.27 pounds per foot unless otherwise indicated on the  
27 Standard Details.

28  
29 Gate posts shall be as indicated on the Standard Details or as submitted by the Construction  
30 Subcontractor and approved by the Project Engineer.

31  
32 All posts, rails, and braces shall be equal to or greater than specified size.

33  
34 FENCE FITTINGS:

35  
36 Provide fittings for a complete fence installation, including special fittings for corners.  
37 Comply with ASTM F626.

38  
39 WIRE TIES :

40  
41 Use 9-gage minimum wires conforming to ASTM F626 for tying chain link fabric to rails,  
42 posts and braces.

43  
44 Wire ends shall be bent to minimize hazards to persons or clothing.

45



1    TENSION WIRE :

2  
3    Tension wire shall be 9-gage coated coil spring wire, with metal and finish matching that of  
4    new fabric conforming to ASTM A824.

5  
6    Locate at bottom of chain link fabric on new fence. The Construction Subcontractor may use  
7    either option.

8  
9        Option 1: Tension wire shall be installed within 2 inches of the ground surface.

10  
11       Option 2: Locate 1.66-O.D. tension rods to support woven wire fabric, 1 inch above  
12       the ground surface.

13  
14    TENSION RODS:

15  
16    In areas where chain link fence is constructed across plant mix paved areas, the tension wire  
17    shall be replaced with a 1.66-O.D. tension rod located a maximum of 1 inch above the plant  
18    mix surface.

19  
20    The tension rod shall be attached to adjacent posts.

21  
22    GATES:

23  
24    General:

25  
26        Gate Operation: Opened and closed easily by one person.

27  
28        Chain Link Fabric: Attached securely to gate frame at intervals not exceeding  
29       15 inches.

30  
31       Gate latch shall provide provisions for the installation and use of standard heavy-duty  
32       locking devices.

33  
34    Swing Gates: ASTM F900.

35  
36       Swing gates shall have the capacity to open 90 degrees, one way from the closed  
37       position.

38  
39       Gate posts and frame shall be of galvanized pipe as shown on the Standard Details.

40  
41       Bolt fasteners on the gates shall be peened to prevent unauthorized removal.

42  
43       Gate Hardware and Accessories: All hardware and accessories shall be hot dip  
44       galvanized. Double leaf gates shall have fork type latch with center drop rod with a  
45       positive locking gravity device, arranged to engage the gate stop.

Rolling Gates:

Track Rollers: Malleable iron or heavy pressed steel with provision for grease lubrication.

Ground Rollers: Malleable iron or heavy pressed steel with provision for grease lubrication.

Support Posts: Spaced on maximum 7-foot centers.

Gates more than 8 feet in height shall have three tracks.

Frames: ASTM F1184, Type I.

Gate Accessories: ASTM F1184.

CONCRETE:

Concrete for fence posts shall be Class 30 (3000 psi).

No test cylinders shall be required for fencing work.

GROUNDING:

Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

Material Above Finished Grade: Copper.

Material On or Below Finished Grade: Copper.

Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

Connectors and Ground Rods: Listed in UL 467.

Connectors for Below-Grade Use: Exothermic welded type or listed nonreversible compression fittings.

Ground Rods: Copper-clad steel 5/8 inch by 120 inches.

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1 PART 3--EXECUTION

2  
3 GENERAL:

4  
5 Install chain link fences and gates in accordance with ASTM F567 and as shown on the  
6 Standard Details, except as modified in this section.

7  
8 Drill holes for post footings in firm, undisturbed or compacted (95 percent relative  
9 compaction) soil.

10  
11 Place concrete around posts in a continuous pour and tamp for consolidation.

12  
13 Verify that each post is plumb and at the proper elevation and alignment.

14  
15 Set keepers, stops, sleeves and any other accessories into concrete as required.

16  
17 TOP RAILS:

18  
19 Run rail continuously through post caps.

20  
21 Provide expansion couplings as recommended by fencing manufacturer.

22  
23 CENTER RAILS:

24  
25 Install in one piece between posts and flush with post on fabric side, using special offset  
26 fittings where necessary.

27  
28 BRACE ASSEMBLIES:

29  
30 Install braces so posts are plumb when diagonal rod is under proper tension.

31  
32 STEEL FABRIC:

33  
34 Pull fabric taut and tie to posts, rails, and tension wires.

35  
36 Install fabric on sides of posts exterior to the enclosed area and anchor to framework so that  
37 fabric remains in tension after pulling force is released.

38  
39 STRETCHER BARS:

40  
41 Thread through or clamp to fabric every 4 inches, and secure to posts with metal bands  
42 spaced 16 inches o.c.

43

1 TIE WIRES:

2  
3 Tie wires shall be attached to chain link fabric as specified in ASTM F626.

4  
5 Bend wire to minimize hazard to persons or clothing.

6  
7 TENSION WIRE:

8  
9 Install tension wire on new fence before stretching fabric and tie to each post with not less  
10 than 9-gage galvanized wire.

11  
12 Fasten fabric to tension wire using 11-gage galvanized steel hog rings spaced 24 inches o.c.

13  
14 Install tension wire with chain link fabric only. Do not use with plastic fence fabric.

15  
16 The tension wire at the bottom of the woven wire fabric shall be embedded a minimum of  
17 2 inches below grade.

18  
19 FASTENERS:

20  
21 Install nuts for tension bands and hardware bolts on side of fence opposite fabric side.

22  
23 GATES:

24  
25 Install gates plumb, level, and secure for full opening without interference.

26  
27 Install ground-set items in concrete for anchorage, as recommended by fence manufacturer.

28  
29 Adjust hardware for smooth operation and lubricate where necessary. Hinges shall be  
30 installed to prevent removal by lifting off. Bolt fasteners shall be peened to prevent removal.

31  
32 GROUNDING:

33  
34 Install at maximum intervals as indicated on Standard Details. Ground fence on each side of  
35 gate opening. All fence and gates shall be grounded as specified in DOE-ID-AES 1639-4.

36  
37 Bond metal gates to gate posts and bond across openings, with and without gates, except  
38 openings indicated as intentional fence discontinuities. Grounding will be installed to all  
39 fencing and gates within 100 feet of overhead power lines.

40  
41 Use No. 2/0 AWG wire and bury it at least 12 inches below finished grade.

42  
43 At each grounding location, drive a ground rod vertically until the top is 6 inches below  
44 finished grade. Connect rod to fence as shown on the Standard Details. Connect bonding  
45 jumper between gate post and gate frame.

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BONDING TO LIGHTNING PROTECTION SYSTEM:

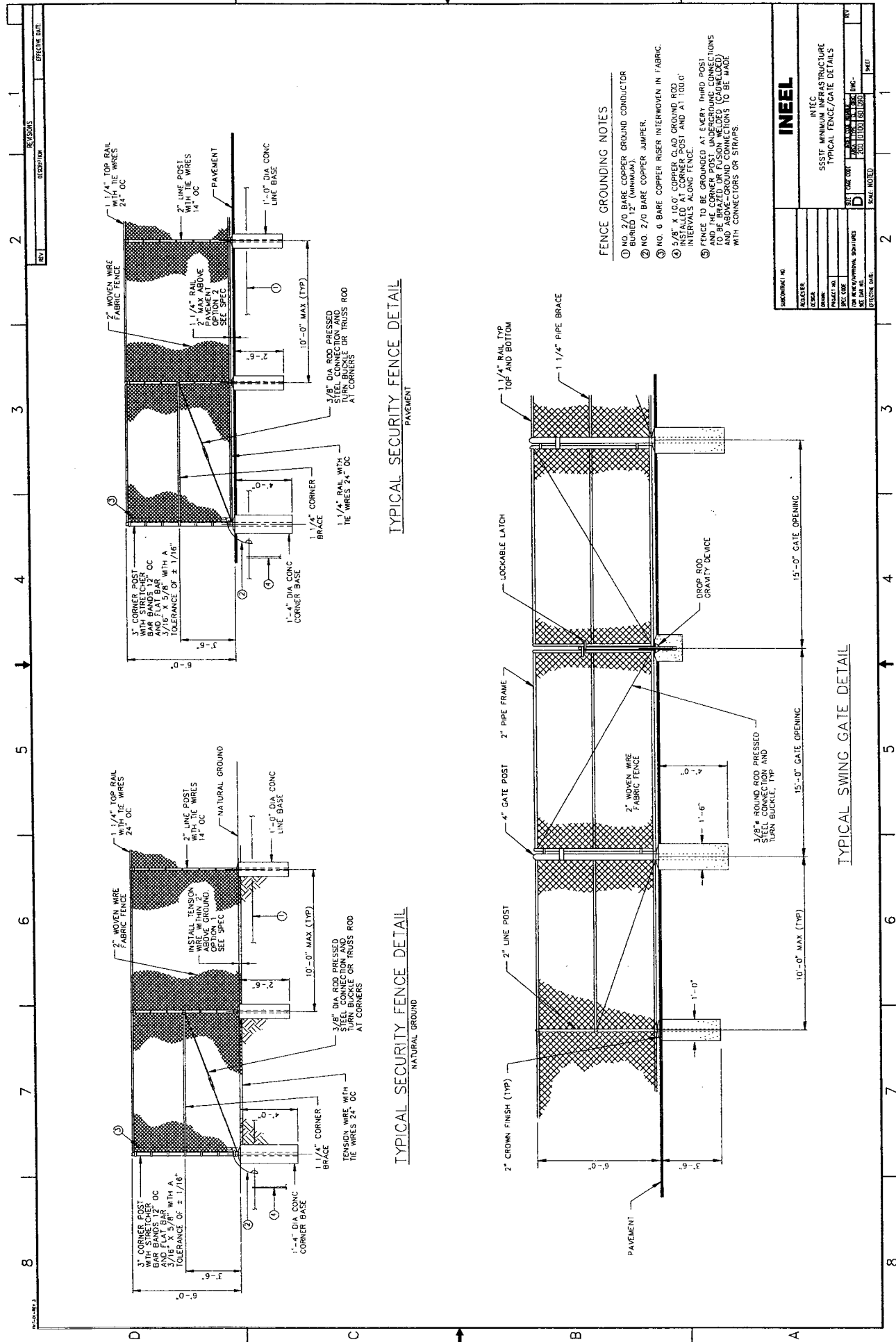
If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to the lightning protection down conductor or lightning protection ground conductor complying with NFPA 780.

SUPPLEMENT:

The supplement listed below, following “END OF SECTION,” is part of this specification.

INTEC-SSSTF Minimum Infrastructure Typical Fence/Gate Details.

END OF SECTION 02444



PROJECT NO.		200-000000
SHEET NO.		1
DATE		10/10/2010
BY		INC
CHECKED BY		INC
SCALE		AS SHOWN
PROJECT NAME		SSSIF MINIMUM INFRASTRUCTURE
PROJECT LOCATION		TYPICAL FENCE/GATE DETAILS
PROJECT NO.		200-000000
SHEET NO.		1
DATE		10/10/2010
BY		INC
CHECKED BY		INC
SCALE		AS SHOWN
PROJECT NAME		SSSIF MINIMUM INFRASTRUCTURE
PROJECT LOCATION		TYPICAL FENCE/GATE DETAILS

PROJECT NO.		200-000000
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PROJECT LOCATION		TYPICAL FENCE/GATE DETAILS

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SECTION 02661--GEOMEMBRANES

PART 1--GENERAL

REFERENCES:

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

ASTM D638	Standard Test Method for Tensile Properties of Plastics.
ASTM D1004	Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
ASTM D1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique.
ASTM D1603	Standard Test Method for Carbon Black in Olefin Plastics.
ASTM D4218	Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
ASTM D5199	Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
ASTM D5397	Evaluation of Stress Crack Resistance of Polyolefin Geomembrane Using Notched Constant Tension Load Test (Appendix A, Single Point).
ASTM D5596	Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
ASTM D5994	Standard Test Method for Measuring Core Thickness of Textured Geomembranes
ASTM D6392	Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

DEPARTMENT OF ENERGY (DOE)

DOE	DOE-ID-10851 Draft INEEL CERCLA Disposal Facility Construction Quality Assurance Plan.
-----	--

1 DESCRIPTION:

2  
3 The Work includes manufacture, fabrication (if needed), supply, and installation of  
4 geomembrane for lining of the waste disposal facility (landfill), for the final evaporation  
5 pond, and for other geomembrane applications, as shown on the Drawings. Geomembrane is  
6 also referred to as flexible membrane liner (FML).

7  
8 PART 2--PRODUCTS

9  
10 GENERAL:

11  
12 Landfill Geomembrane: High density polyethylene (HDPE). Unreinforced, 60-mil nominal  
13 thickness, textured both sides.

14  
15 Evaporation Pond Geomembrane: The sacrificial and secondary geomembrane shall be  
16 HDPE, unreinforced 60-mil nominal thickness, textured both sides. Smooth surface HDPE,  
17 60-mil nominal thickness, shall be used for the primary geomembrane.

18  
19 Manufacturer: Textured HDPE geomembrane shall be HD Smooth Edge Textured and  
20 smooth surface HDPE geomembrane shall be HD as manufactured by GSE Lining  
21 Technology, Inc., Houston, TX.

22  
23 REQUIRED PROPERTIES - POLYETHYLENE GEOMEMBRANES:

24  
25 Use of Recycled Polymer: The raw material shall be new polyethylene resin containing no  
26 more than 2 percent clean recycled polymer by weight. 2 percent recycled polymer shall not  
27 include any finished sheet material that has actually seen some type of service performance.  
28 Regrind, reworked, or trim materials in the form of chips or edge strips that have not actually  
29 seen some type of use may be added, if the material is from the same manufacturer and is the  
30 same formulation as the geomembrane being produced.

31  
32 Resin Properties: The resin shall meet the following Specifications:

33  
34 HDPE:

35  
36 Resin Specific Gravity (ASTM D1505): >0.932.

37  
38 Melt Index (ASTM D1238 Condition 190/2.16): ≤1.0 g/10 min.

39  
40 Finished Sheet Properties: The physical, mechanical, and environmental properties of the  
41 finished sheet shall meet or exceed the values specified in Tables 1 and 2 contained in this  
42 part of the Specifications. Where applicable, values in Tables 1 and 2 are Minimum Average  
43 Values.



Manufacturer's Information: The manufacturer shall provide specification sheets, literature, and factory test results for all properties listed in these Specifications. The manufacturer shall certify that the materials supplied meet the requirements of this Part. Manufacturer shall also provide documentation of manufacturing quality control for uniformity and consistency of texturing applied to the surface of HDPE geomembrane.

Tensiometer for Field Testing:

Motor driven with jaws capable of traveling at measured rate of 2 inches per minute.

Equipped with gauge which measures force in unit pounds exerted between jaws.

Force Tech 5002 DPR portable tensile tester as furnished by Columbine International, Ltd., Placerville, CA; or approved equal.

Plywood Sheeting: Use APA rated sheeting EXT for protection of the HDPE geomembrane at termination edges on south side of Cell 1 at Cell 1/Cell 2 interface.

Marking Media: Shall not possess solvent bases and must be compatible with HDPE resin.

PART 3--EXECUTION

GENERAL:

Installation Plan: Prior to beginning geomembrane installation, the Geomembrane Installer shall submit a plan describing the proposed size, number, position and sequence of geomembrane panel placement, and location of field seams.

SOIL BENTONITE LINER SURFACE PREPARATION - POLYETHYLENE GEOMEMBRANES:

The Construction Subcontractor shall be responsible for preparing the surface of the soil bentonite liner for the geomembrane. Prepare the underlying soil surface as specified in Section 02319, SUBGRADE PREPARATION, and as approved by the Geomembrane Installer.

The Geomembrane Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. The certificate of acceptance shall be given by the Installer to the Subcontractor's Construction Manager prior to commencement of geomembrane installation in the area under consideration. The form for Geomembrane Installer certification is provided as Supplement to this Specification. Submittal of this form only applies to soil surfaces underlying the geomembrane. In this case Geomembrane Installer Certificate of Acceptance is only required for the surface on which the secondary and tertiary geomembranes for the landfill shall be installed.

After the soil bentonite liner surface has been accepted by the Installer, it shall be the Installer's responsibility to indicate to the Subcontractor's Construction Manager any change in the soil bentonite liner surface condition that may require repair work.

Special care shall be taken to avoid desiccation cracking or freezing of the soil bentonite liner. Specifications for allowable desiccation cracking of soil liner and repair measures are contained in Section 02666, SOIL BENTONITE LINER. The surface of the soil bentonite liner shall be maintained in the required condition throughout the course of geomembrane installation.

#### ANCHOR TRENCH EXCAVATION AND BACKFILLING:

The anchor trench shall be excavated to the lines and widths shown on the design Drawings, prior to geomembrane placement. The corners of the trench shall be rounded so as to avoid sharp bends in the geomembrane. No loose soil shall be allowed to underlie the geomembrane in the anchor trench. Backfill with material as shown on the Drawings and compact as specified in Section 02320, TRENCH BACKFILL.

#### GEOMEMBRANE PLACEMENT - POLYETHYLENE GEOMEMBRANES:

Field Panel Identification: A field panel is the unit area of geomembrane which is to be seamed in the field. Two cases are defined:

If the geomembrane is fabricated into panels in a factory, a field panel is a factory panel or a portion of factory panel cut in the field.

If the geomembrane is not fabricated into factory panels, a field panel is a roll or a portion of roll cut in the field.

Construction Subcontractor shall assign each field panel an "identification code" (number or letter-number) consistent with the layout plan. This field panel identification code shall be as simple and logical as possible. (Note that roll numbers assigned in the manufacturing plant are usually cumbersome and are not related to location in the field.)

#### Field Panel Placement:

Location: Field panels shall be installed at the locations indicated in the Installer's layout plan, as approved or modified.

Installation Schedule: Only as many field panels shall be deployed each day as can be continuously welded that same day.

Placement Conditions: Geomembrane placement shall not proceed at an ambient temperature below 32 degrees F or above 104 degrees F as measured 6 inches above the geomembrane

surface unless installation procedures approved by the BBWI Construction Manager are in place to address environmental conditions. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds. Placement methods shall prevent damage to underlying soil liner or geosynthetic materials.

Factors such as expansion, contraction, overlap at seams, anchorage requirements, seaming progress, and drainage shall be considered. Textured-surface sheets shall be aligned in a manner which maximizes their frictional capabilities along the slope. Maneuver sheets of geomembrane into place in a manner which prevents wrinkles, folds, or similar distress which can damage the geomembrane or prevent its satisfactory alignment or seaming. A smooth-surface HDPE geomembrane rub sheet shall be used when placing textured HDPE geomembrane over underlying GCL. The rub sheet shall be maintained in good condition without tears, rough edges, holes, or scuff marks that can catch, displace, or otherwise disturb the underlying GCL, or the overlying geomembrane.

Damage: Damaged panels or portions of damaged panels which have been rejected shall be removed from the work area. Any repairs shall be made according to procedures described in this Part of the Specifications.

Ultraviolet (UV) Radiation Protection: After panel deployment, all geomembrane, except those shown as permanently exposed on the Drawings, shall be covered to prevent exposure to UV radiation within a maximum period of 1 calendar year. Geomembrane panels shall be covered by other geosynthetic components of the lining system or overlying soil cover materials as shown on the Drawings.

#### FIELD SEAMING - POLYETHYLENE GEOMEMBRANES:

Seaming Equipment and Products: Approved processes for field seaming are extrusion welding and fusion welding, except that use of extrusion welding shall be limited to areas (such as sumps or repairs) where fusion welding cannot be employed. Proposed alternate processes shall be documented and submitted to the BBWI Construction Manager for approval. Only equipment which has been specifically approved by make and model shall be used.

Extrusion Process: The extrusion-welding machine shall be equipped with gages capable of measuring the temperature at the nozzle or the preheat temperature.

The Installer shall provide documentation regarding the extrudate and shall certify that the extrudate is compatible with these Specifications and is comprised of the same resin type as the geomembrane sheeting.

The Installer shall comply with the following:

The Installer shall maintain on-site a sufficient number of spare operable seaming machines (at least one at all times) to ensure continuous operation.

The equipment used for seaming shall not be likely to damage the geomembrane.

The extruder shall be purged prior to beginning a seam until all heat-degraded extrudate has been removed from the barrel.

The electric generator shall be placed on a smooth base such that no damage occurs to the geomembrane.

Grinding shall be completed no more than 1 hour prior to seaming. A smooth insulating plate or fabric shall be placed beneath the hot welding machine after usage.

The geomembrane shall be protected from damage in heavily trafficked areas.

Fusion Process: The fusion-welding machines shall be automated vehicular-mounted devices. The fusion-welding machines shall be equipped with gages giving the pertinent temperatures.

The Installer shall comply with the following:

The Installer shall maintain on-site a sufficient number of spare operable seaming machines (at least one at all times) to ensure continuous operations.

The equipment used for seaming shall not be likely to damage the geomembrane.

For cross seams, the edge of the cross seam shall be ground to a smooth incline (top and bottom) prior to welding.

The electric generator shall be placed on a smooth base such that no damage occurs to the geomembrane.

A smooth insulating plate or fabric shall be placed beneath the hot welding machine after usage.

The geomembrane shall be protected from damage in heavily trafficked areas.

A movable protective layer shall be used directly below each overlap of geomembrane to be seamed to prevent buildup of moisture between the sheets.

Seam Layout:

In general, seams shall be oriented parallel to the line of maximum slope, i.e., oriented up and down, not across, the slope. In corners and odd-shaped geometric locations, the number of seams shall be minimized. On the landfill floor, no horizontal seam shall be less than 5 feet from the toe of the slope, or other area of potential stress concentrations.

Seams shall be aligned to produce the fewest possible number of wrinkles and “fishmouths.”

A seam numbering system consistent with the panel numbering system shall be utilized.

Weather Conditions for Seaming: The allowable weather conditions for seaming are as follows:

Unless authorized in writing by the BBWI Construction Manager, no seaming shall be attempted at ambient temperatures below 32 degrees F or above 104 degrees F as measured 6 inches above the geomembrane surface.

The geomembrane shall be dry, protected from wind, and free of dust.

If the Installer wishes to use methods which may allow seaming at ambient temperatures below 32 degrees F, the Installer shall certify in writing that the quality of the seams welded at these temperatures is the same as the quality of seams welded at temperatures above 32 degrees F. In addition, if the Installer wishes to seam at ambient temperatures below 32 degrees F, the following conditions shall be satisfied in addition to the general seaming procedures:

For extrusion welding, preheating shall be performed. Preheating may be waived if it is demonstrated that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.

Sheet grinding, if required, may be performed before preheating.

Observe all areas of the geomembrane that have been preheated to determine that they have not been subjected to excessive melting.

Confirm that geomembrane surface temperatures have not decreased below the minimum specified for welding, due to wind or other adverse conditions. Wind protection for the seam area may be required.

Trial seams, as described in Paragraph Trial Seams of this section, shall be made in the immediate area where seaming will occur, under the same ambient temperature and preheating conditions as the actual seams. New trial seams shall be made if the ambient temperature decreases by more than 5 degrees F from the previous trial seam conditions. Such new trial seams shall be conducted as soon as seams in progress during the temperature drop have been completed.

Additional destructive seam tests, as described in Paragraph Destructive Seam Strength Testing of this section, shall be performed at intervals of 250 to 500 feet of seam length.

The Installer shall provide sample coupons cut from each end of the seam.

#### Seam Preparation:

Cleaning: Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material. Special attention shall be paid to cleaning the existing geomembrane at tie-in locations.

Overlap: Cross slope seams on both the trench floor and sideslopes shall be overlapped so that liquids are not trapped, i.e., seams shall be shingled downslope. If seam overlap grinding is required, the process shall be completed according to the geomembrane manufacturer's instructions within 1 hour of the seaming operation, and in a way that does not damage the geomembrane. Panels of geomembrane shall have a finished overlap of a minimum of 2 inches for extrusion welding and 4 inches for fusion welding.

Use of Solvents: No solvent or adhesive shall be used.

Temporary Bonding: The procedure used to temporarily bond adjacent panels together shall not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any spot welding apparatus shall be controlled such that the geomembrane is not damaged.

General Seaming Procedure: The general seaming procedure used by the Installer shall be as follows:

Seaming shall extend to the outside edge of panels to be placed in the anchor trench.

1 If required, a firm substrate shall be provided by using a flat board, a conveyor belt,  
2 or similar hard surface directly under the seam overlap to achieve proper support.  
3

4 If seaming operations are carried out at night, adequate illumination shall be  
5 provided.  
6

7 “Fishmouths” or wrinkles at the seam overlaps shall be cut along the ridge of the  
8 wrinkle in order to achieve a flat overlap. The cut “fishmouths” or wrinkles shall be  
9 seamed, and any portion where the overlap is inadequate shall then be patched with  
10 an oval or round patch of the same geomembrane extending a minimum of 6 inches  
11 beyond the cut in all directions.  
12

13 Geomembrane in sump areas shall be installed and tested as described in this Part for  
14 other areas of the landfill, as practicable. Extreme care shall be taken while welding  
15 around appurtenances since neither nondestructive nor destructive testing may be  
16 feasible in these areas. The Installer shall ensure that the geomembrane is not visibly  
17 damaged during installation.  
18

#### 19 TESTING - POLYETHYLENE GEOMEMBRANES: 20

21 General: Testing requirements specified herein are intended for the Construction  
22 Subcontractor (and Geomembrane Installer) during geomembrane installation. Testing  
23 requirements for the Construction Quality Assurance (CQA) Certifying Engineer are  
24 provided in the CQA Plan (DOE-ID-10851).  
25

26 Trial Seams: Trial seams shall be made on fragment pieces of geomembrane liner to verify  
27 that seaming conditions are adequate. Trial seams shall be made at the beginning of each  
28 seaming period, and at least once each 4 hours, for each seaming machine used that day.  
29 Also, each seamer shall make at least one trial seam each day. Trial seams shall be made  
30 under the same conditions as actual seams.  
31

32 The trial seam sample shall be at least 2 feet long by 1 foot wide (after seaming) with  
33 the seam centered lengthwise. Seam overlap shall be as indicated in this Part.  
34

35 Test at least five specimens for each seam test method (shear and peel). Each  
36 specimen shall be at least 1-inch wide and shall be cut from the trial seam sample by  
37 the Installer. The specimens shall be tested respectively in shear and peel using a field  
38 tensiometer, and they shall not fail in the seam. Four out of five specimens must meet  
39 the minimum requirements for trial seam acceptance. If a specimen fails, the entire  
40 operation shall be repeated. If the additional specimen fails, the seaming apparatus  
41 and seamer shall not be accepted and shall not be used for seaming until the  
42 deficiencies are corrected and two consecutive successful full trial seams are  
43 achieved.  
44

All test equipment shall be in calibration and conform to manufacturer's specifications. The Installer shall provide the BBWI Construction Manager with current calibration certificates.

Nondestructive Seam Continuity Testing:

General: The Installer shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure test (for double fusion seams only), or other approved method. Vacuum testing and air pressure testing are described below. The purpose of the nondestructive test is to check the continuity of seams. It does not provide any information on seam strength. Continuity testing shall be done as the seaming work progresses. Any seams which fail nondestructive testing shall be repaired in accordance with these Specifications. Seams which cannot be non-destructively tested because of seam geometry shall be double welded or capped.

All test equipment shall be in calibration and conform to manufacturer's specifications. The Installer shall submit current calibration certificates.

Vacuum Testing: The equipment shall be comprised of the following:

A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gage.

A steel vacuum tank and pump assembly equipped with a pressure controller and connections.

A rubber pressure/vacuum hose with fittings and connections.

A bucket and wide paint brush.

A soapy solution.

The following procedures shall be used:

Energize the vacuum pump and reduce the tank pressure to a minimum of 5 inches of mercury.

Wet a strip of geomembrane approximately 12 inches wide by 48 inches long with the soapy solution.

Place the vacuum box over the test area.

Close the bleed valve and open the vacuum valve.



1                   Ensure that a leak tight seal is created.

2  
3                   For a period of not less than 10 seconds, examine the geomembrane through  
4                   the viewing window for the presence of soap bubbles.

5  
6                   If no bubble appears after 10 seconds, close the vacuum valve and open the  
7                   bleed valve, move the box over the next adjoining area with a minimum  
8                   3-inch overlap, and repeat the process.

9  
10                  All areas where soap bubbles appear shall be marked and repaired in  
11                  accordance with this Part.

12  
13                  Air Pressure Testing: The following procedures are applicable only to those processes  
14                  which produce a double seam with an enclosed air channel. All double seams with an  
15                  enclosed air channel shall be air pressure tested. The equipment shall be comprised of  
16                  the following:

17  
18                  An air pump (manual or motor driven) capable of generating and sustaining a  
19                  pressure of 60 to 65 psi.

20  
21                  A rubber hose with fittings and connections.

22  
23                  A sharp hollow needle, or other approved pressure feed device.

24  
25                  A calibrated pressure gage capable of reading pressures up to 65 psi.

26  
27                  The following procedures shall be used:

28  
29                  Seal both ends of the seam to be tested.

30  
31                  Insert needle with pressure gage, or other approved pressure feed device, into  
32                  the air channel created by the fusion weld.

33  
34                  Energize the air pump and pressurize the channel to between 25 and 30 psi for  
35                  a 1/2-inch wide channel, or 55 and 60 psi for a 1-inch wide channel. Close the  
36                  valve and sustain the pressure for a minimum of 5 minutes.

37  
38                  If loss of pressure exceeds 2 psi, or does not stabilize, locate faulty area and  
39                  repair in accordance with this section. If significant changes in geomembrane  
40                  temperature occur during the test (e.g., due to cloud cover), the test shall be  
41                  repeated after the geomembrane temperature has stabilized.

42  
43                  Cut end of seam opposite to the pressure gage and observe that the pressure  
44                  drops. If the pressure does not drop, locate the obstruction(s) in the seam,  
45                  repair, and retest seam.

Remove needle or other approved pressure feed device and repair seam.

Destructive Seam Strength Testing:

General: Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses. The samples shall meet the requirements of Table 3, "Seam Properties."

All test equipment shall be in calibration and conform to manufacturer's specifications. The Installer shall submit current calibration certificates.

Each sample shall be tested for bonded seam shear and peel strength by an independent testing laboratory.

Test at least five specimens for each seam test method (shear and peel). Four out of five specimens must meet the minimum requirements for field seam acceptance.

Location and Frequency: Destructive seam samples shall be obtained from actual fabricated field seams as work progresses, not at the completion of field seaming.

Sampling frequency shall be a minimum of one sample per 500 feet of seam length per welding machine (this minimum frequency shall be determined as an average taken from all the panels, including welds for caps), or a minimum of two samples per factory panel, whichever gives the largest number of samples.

Sampling Procedures: Samples shall be cut by the Installer as the seaming progresses in order to provide laboratory test results before completion of installation. The Installer shall assign a number to each sample, mark it accordingly, and record the sample location on the layout drawing.

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with repair procedures. The continuity of the new seams in the repaired area shall be tested as described in this Part.

Sample Size: The samples shall be 12 inches wide by 36 inches long with the seam centered lengthwise. One 1-inch wide strip shall be cut from each end of the samples, and these shall be tested in the field as described below. The remaining sample shall be distributed as specified in the CQA Plan (DOE-ID-10851).

Field Testing: The two 1-inch wide strips described above shall be tested in the field by tensiometer for peel and shear and shall not fail in the seam. If any test sample

1 fails to pass, then the procedures outlined below (Procedures for Areas Failing  
2 Destructive Tests) shall be followed.

3  
4 Mark all samples and portions with their number. Record the date and time, ambient  
5 temperature, number of seaming unit, name of seamer, welding apparatus  
6 temperatures and pressures, and pass or fail descriptions, and attach a copy to each  
7 sample portion.

8  
9 Procedures for Areas Failing Destructive Tests: The following procedures shall apply  
10 whenever a sample fails a destructive test, whether that test is conducted by the  
11 independent testing laboratory, the Installer's laboratory, or by field tensiometer. The  
12 Installer has two options:

13  
14 The Installer shall cap the seam between any two passing test locations, or

15  
16 The Installer shall trace the seam to two intermediate locations 10 feet  
17 minimum from the point of the failed test in each direction and take a small  
18 sample for an additional field test at each location. If these additional samples  
19 pass the test, then full samples shall be taken for laboratory testing. If these  
20 laboratory samples pass the tests, then the seam shall be capped between these  
21 locations. If either sample fails, then the sampling and testing process shall be  
22 repeated to establish the zone over which the seam shall be capped.

23  
24 All acceptable capped seams shall be bounded by two locations from which samples  
25 passing laboratory destructive tests have been taken. In cases where the length of the  
26 capped seam exceeds 150 feet, a sample of the capping seam shall be taken and shall  
27 pass destructive testing as described in this Part.

## 28 29 REPAIRS - POLYETHYLENE GEOMEMBRANES:

30  
31 General: Any portion of the geomembrane exhibiting a flaw or failing a destructive or  
32 nondestructive test shall be repaired. All repairs shall be conducted in accordance with this  
33 Part. All repairs shall be subjected to the nondestructive seam testing procedures described in  
34 this Part.

35  
36 Each patch or other type of repair will be numbered and recorded.

### 37 38 Repair Procedures:

39  
40 Patching, used to repair large holes, tears, undispersed raw materials, and  
41 contamination by foreign matter.

42  
43 Grinding and rewelding, used to repair small sections (typically with a maximum  
44 length of no more than several inches) of extruded seams.

Spot welding or seaming, used to repair pinholes or other minor, localized flaws.

Capping, used to repair large lengths of failed seams or areas where large wrinkles or fish mouths have been cut to flatten the geomembrane sheet.

Topping, used to repair areas of inadequate seams which have an exposed edge. Topping shall be limited to an aggregate length of no more than 3 m (10 feet) on any given seam.

Removing bad seam and replacing with a strip of new material welded into place, used with large lengths of fusion seams.

For all repair methods, the following provisions shall be satisfied as applicable:

Surfaces of the geomembrane which are to be repaired shall be abraded no more than one hour prior to the repair.

All surfaces shall be clean and dry at the time of the repair.

Patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 inches.

The geomembrane below large caps shall be appropriately cut to avoid water or gas collection between the two sheets.

Verification of Repairs: Each repair shall be numbered and recorded. Each repair shall be nondestructively tested using the methods described in this Part. Large caps may be of sufficient extent to require destructive test sampling. Repairs that fail nondestructive or destructive tests shall be redone and retested until a passing test is obtained.

#### PROTECTION OF TERMINATION EDGES:

Along the south termination of the geomembrane, and along any termination edges of the membrane that may be exposed or buried for extended periods of time prior to their joining to adjacent subsequent sections, the Construction Subcontractor shall protect leading edges with protective (sacrificial) layers of cushioning geotextile and plywood sheet as shown on the Drawings.

#### MATERIALS IN CONTACT WITH GEOMEMBRANE:

The requirements of this Part are intended only to assure that the installation of other materials does not damage the geomembrane. Additional requirements as established in other sections of these Specifications are necessary to assure that systems built with these other materials are constructed in such a way as to provide proper performance. Material

requirements for operations layer, drain gravel, and drain sand are specified in Section 02315, FILL AND BACKFILL.

Requirements of this Part apply to geomembranes that are directly in contact with overlying soil or are covered with a layer of geotextile or geocomposite.

Do not place granular materials in manner that will cause wrinkles to fold over or become confined to form a vertical ridge. Maximum wrinkle height shall be 4 inches and spacing between wrinkles shall be greater than 10 feet prior to placement of granular materials over the geomembrane.

Minimum Thickness: Equipment used for spreading granular material shall not be driven directly on the geomembrane. A minimum thickness of 1 foot of granular material shall be maintained between spreading equipment and the geomembrane. A minimum thickness of 3 feet of granular material shall be maintained between rubber-tired hauling vehicles and the geomembrane. Haul vehicles shall have a maximum ground contact pressure of 25 psi.

Spreading Equipment: Equipment used for spreading granular material shall be a light low ground pressure dozer (such as a wide-pad Caterpillar D6M LGP or lighter), low ground pressure excavator (Bucyrus-Erie 325H with 0.91-m [36-in] wide treads or lighter), or approved equal, with a maximum ground contact pressure of 5 psi.

Spreading Operations: Spreading equipment operating on soil materials shall not spin their tracks, make sharp turns, or make sharp, rapid starts or stops. Soil materials shall be pushed carefully from previously placed material and not dumped directly onto geosynthetics. Placement of soil materials on the geomembrane will not be allowed within 50 feet of any unseamed edge of geomembrane.

The spreading operation shall begin at the lower elevations and shall proceed either upslope or laterally at about the same elevation such that a full layer of granular material is always covering the geomembrane downslope from the area being covered. In no case shall the lift thickness be less than the stated minimum. Material shall be placed in such a manner that no air is trapped underneath the geomembrane. Provide and maintain a means of continuously observing the depth of granular materials such as by freestanding markers until placement is complete, at intervals of 50 feet maximum each way. Sharpened stakes or methods that could damage the geomembrane will not be allowed.

#### SUPPLEMENTS:

The supplements listed below, following "END OF SECTION," are a part of this Specification.

Table 1. Required Geomembrane Properties, 60-mil Textured HDPE.

Project Title: ICDF Landfill and Evaporation Pond RD/CWP – Title II  
Document Type: Technical Specifications  
SPC Number: 1476  
Revision Number: 1

- 1 Table 2. Required Geomembrane Properties, 60-mil Smooth HDPE.
- 2
- 3 Table 3. Required Seam Properties.
- 4
- 5 Geomembrane Installer's Certification of Subsurface Acceptability.
- 6
- 7 END OF SECTION 02661

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**Table 1. REQUIRED GEOMEMBRANE PROPERTIES**  
**60-mil TEXTURED HDPE**

<u>Property</u>	<u>Qualifier</u>	<u>Unit</u>	<u>Specified Value</u>	<u>Test Method</u>
Thickness	min. avg. value	mils	60	ASTM D5994
	lowest individual reading		51	ASTM D5994
Specific Gravity	lowest individual reading	N/A	0.932	ASTM D1505
Melt Index	maximum	g/10 min	1.0	ASTM D1238 condition 190/2.16
Tensile Properties (each direction)				ASTM D638 (Type IV)
Strength at yield	min. avg. value	lb/in	120	
Elongation at yield <sup>1</sup>	min. avg. value	%	12	
Tear Resistance	min. avg. value	lb	42	ASTM D1004
Puncture Resistance	min. avg. value	lb	80	ASTM D4833
Carbon Black Content	range	%	2-3	ASTM D1603 or D4218
Carbon Black Dispersion	minimum 8 of 10	category	1 or 2	ASTM D5596
Environmental Stress Crack	minimum <sup>2</sup>	hrs	200	ASTM D5397

<sup>1</sup>Yield elongation is calculated using a gauge length of 1.3 inches.

<sup>2</sup>Minimum = mean minus 3 standard deviations from documented manufacturer's quality control (MQC) testing.

**Table 2. REQUIRED GEOMEMBRANE PROPERTIES**  
**60-mil SMOOTH HDPE**

<u>Property</u>	<u>Qualifier</u>	<u>Unit</u>	<u>Specified Value</u>	<u>Test Method</u>
Thickness	min. avg. value	mils	60	ASTM D5199
	lowest individual reading		54	ASTM D5199
Specific Gravity	lowest individual reading	N/A	0.932	ASTM D1505
Melt Index	maximum	g/10 min	1.0	ASTM D1238 condition 190/2.16
Tensile Properties (each direction)				ASTM D638 (Type IV)
Strength at yield	min. avg. value	lb/in	120	
Elongation at yield <sup>3</sup>	min. avg. value	%	12	
Tear Resistance	min. avg. value	lb	42	ASTM D1004
Puncture Resistance	min. avg. value	lb	80	ASTM D4833
Carbon Black Content	range	%	2-3	ASTM D1603 or D4218
Carbon Black Dispersion	minimum 8 of 10	category	1 or 2	ASTM D5596
Environmental Stress Crack	minimum <sup>4</sup>	hrs	200	ASTM D5397

<sup>3</sup>Yield elongation is calculated using a gauge length of 1.3 inches.

<sup>4</sup>Minimum = mean minus 3 standard deviations from documented MQC testing.



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**Table 3. REQUIRED SEAM PROPERTIES**  
**HDPE GEOMEMBRANES**

<u>Property</u>	<u>Qualifier</u>	<u>Unit</u>	<u>Specified Value</u>	<u>Test Method</u>
Shear Strength <sup>5</sup>	minimum	lb/in width	90% of tensile strength at yield as listed in tables in this section	ASTM D6392
Peel Adhesion	minimum	lb/in width	60% of tensile strength at yield as listed in tables in this section and FTB <sup>6</sup>	ASTM D6392

<sup>5</sup>Also called “Bonded Seam Strength.”

<sup>6</sup>FTB = Film Tear Bond (failure occurs through intact geomembrane, not through seam).

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GEOMEMBRANE INSTALLER'S CERTIFICATION  
OF SUBSURFACE ACCEPTABILITY

The geomembrane installer, \_\_\_\_\_  
for the INEEL CERCLA Disposal Facility and Evaporation Pond, hereby certify that the  
supporting prepared subgrade surfaces are acceptable for installation of the HDPE  
geomembrane lining system, the undersigned having personally inspected the condition of  
the constructed surfaces. This certification is for the areas shown on Attachment or defined  
as follows:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

The condition of the supporting surfaces in the defined area meets or exceeds the minimum  
requirements for installation of the geomembrane.

Signed: \_\_\_\_\_  
Geomembrane Installer

Signed: \_\_\_\_\_  
Construction Subcontractor

\_\_\_\_\_  
Date Signed

\_\_\_\_\_  
Date Signed

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SECTION 02666--SOIL BENTONITE LINER

PART 1--GENERAL

REFERENCES:

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |            |   |
|------------|---|
| ASTM D698  | Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbs/ft <sup>3</sup> ) (600 Kn-m/m <sup>3</sup> )   |
| ASTM D422  | Method for Particle-Size Analysis of Soils  |
| ASTM D1557 | Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbs/ft <sup>3</sup> ) (2,700 Kn-m/m <sup>3</sup> ) |
| ASTM D2216 | Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass  |
| ASTM D6391 | Standard Test Method for Field Measurement of Hydraulic Conductivity Limits of Porous Materials Using Two Stages of Infiltration from a Borehole  |

DEPARTMENT OF ENERGY (DOE)

- |              |  |
|--------------|--|
| DOE/ID-10851 | Draft Final Construction Quality Assurance Plan for the INEEL CERCLA Disposal Facility |
|--------------|--|

DESCRIPTION:

This section describes the low permeability soil bentonite admix that will be used in the liner of the disposal facility. In addition requirements for base soil in the evaporation pond lining system are specified.

The soil bentonite liner is an admixture (admix) that consists of natural base soil which is mixed with bentonite and moisture conditioned.

DEFINITIONS:

Grain Size: Determined by ASTM D422.

Imported Material: Meets requirements of this Specification and is obtained offsite and transported to site.

Natural Moisture Content: Determined by ASTM D2216.

Relative Compaction:

Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density and determined in accordance with ASTM D1557.

Apply corrections for oversize material to either as-compacted field dry density or maximum dry density.

Optimum Moisture Content: Determined in accordance with ASTM D1557 specified to determine maximum dry density for relative compaction.

Admix: Natural material (base soil), as specified in this section, that when mixed with bentonite, produces soil bentonite material.

Soil Bentonite Barrier Layer: Compacted liner component consisting of soil bentonite materials, designed, formulated, and constructed to provide low-permeability barrier against infiltration of liquids or contaminants.

Soil Bentonite Material: Admix of base soil and Envirogel 10 bentonite, supplied by Wyo-Ben, Inc., that produces low-permeability material.

TOLERANCES:

Tolerances for thickness of the soil bentonite liner shall be -0 to +4 inches. The minimum required thickness of the soil liner layer shall be maintained. The as-built elevations of the underlying prepared subgrade shall be used as the basis for determining the final elevation of the soil liner layer.

PART 2--PRODUCTS

BENTONITE:

The bentonite shall be Envirogel 10, supplied by Wyo-Ben, Inc. Do not provide calcium bentonites or chemically treated sodium bentonites.

The bentonite to be used in the admix shall consist of a commercially prepared material and shall have the following index properties:

High Swelling: Ability of 2 grams of base bentonite, when mechanically reduced to minus 100 mesh, to swell in water to an apparent volume of 15 cubic centimeters or more when added gradually to 100 cubic centimeters of distilled water contained in graduated cylinder.

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Colloid Content: Exceeding 70 percent, measured by evaporating suspended portion of 2 percent solution, by weight, after 24 hours of sedimentation in glass cylinder or beaker.

Dry Fineness: 98 percent minimum passing the No. 10 U.S. Sieve, and 20 percent maximum passing No. 200 U.S. Sieve.

The Construction Subcontractor shall provide suitable containers on site to store bentonite in a dry condition prior to use.

#### BASE SOIL:

The base soil for the admix liner shall consist of natural soil derived from the Rye Grass Flats borrow area, as specified in Section 02317, BORROW AREA EXCAVATION. This material may be stockpiled at the temporary stockpile area as shown on the Drawings, or within processing area within Cell 1 as approved by the BBWI Construction Manager.

The base soil shall be free of roots, woody vegetation, frozen material, rubbish, and other deleterious material. Rocks greater than 1 inch in dimension shall not comprise more than 2 percent by weight of the base soil. Base soil shall be screened or otherwise processed if necessary to meet this requirement.

#### ADMIX LINER MATERIAL (SOIL BENTONITE):

Composition: The admix shall consist of the base soil mixed with a nominal bentonite content of 5 percent by dry weight. The acceptable range for bentonite content shall be a minimum of 5 percent and maximum of 7 percent of base soil by dry weight. The admix shall be prepared at a moisture content that ranges from approximately 16 to 19 percent. Water for moisture conditioning shall meet the requirements specified in Section 02315, FILL AND BACKFILL. The bentonite percentage and moisture content range may change as a result of preconstruction testing performed on the test pad as described in the CQA Plan (DOE/ID-10851), and may be modified by the Construction Subcontractor with the approval of the BBWI Construction Manager and the CQA Certifying Engineer at any time during the admix processing to reflect changes in the base soil or other components. The moisture content and bentonite dispersion in the admix shall be uniform and homogenous. The finished admix shall be a uniform homogenous material.

#### PART 3--EXECUTION

##### ADMIX PROCESSING:

Bentonite Use Monitoring: Record weight of bentonite used and volume of soil bentonite produced each day.

Processing Using the In-Place Mixing Method:

Place base soil ahead of soil bentonite mixing operation, and grade surface to be relatively smooth and free from irregularities.

Spread bentonite uniformly, using a lime spreader truck, cement spreader truck, or other approved method, across prepared soil admixture surface at minimum application rate as determined by design mix tests. Weigh material on premeasured tarpaulin or drop cloths spread in different locations across area after spreading material to verify proper dosage is being applied.

Thoroughly mix soil bentonite mixture for the full depth of the loose lift thickness using a pulverizer/mixer, heavy duty rotovator, or other suitable equipment that, by actual demonstration, produces thorough and uniform mixture of soil and bentonite, free from lumps or pockets of unmixed materials. Prior to moisture conditioning, the soil bentonite admix shall be broken down in size sufficiently to result in at least 80 percent of soil clods or clumps broken down to 1/2-inch maximum size. Clods are defined as dry, hard particles in the admix that cannot be remolded by hand pressure. Mix in two directions roughly perpendicular using overlapping passes. Methods of mixing without perpendicular passes are also acceptable provided the Construction Subcontractor can demonstrate thorough mixing as specified above.

Condition moisture content of soil bentonite admix, as specified.

Admix shall be processed at least 12 hours prior to placement. The Subcontractor shall be responsible for maintaining the moisture content of the admix within the specified limits. Admix that does not meet Specifications shall not be reused unless approved by the Construction Manager.

TEST PAD(S):

Test pads for the soil bentonite liner shall be constructed as specified in Article SOIL BENTONITE LINER PLACEMENT AND COMPACTION, by the Construction Subcontractor to determine acceptable placement and compaction methods to produce a low-permeability soil bentonite liner that satisfies the requirements of this section. The approximate location of the test pads will be shown on the Drawings and will be verified in the field.

Test Pad Material: The construction subcontractor will prepare a sufficient quantity of soil for the test pad in accordance with the requirements of Article ADMIX LINER MATERIAL. All specified procedures for mixing, conditioning, and stockpiling of the soil material will be followed. In addition, as described in the CQA Plan (DOE/ID-10851) Standard Proctor curves (ASTM D698) shall be performed on the admix liner material to allow evaluation of compactive effort during test pad construction.

1 Slope Test Pad Construction:

2  
3 The test pad will be constructed on a 3H:1V sideslope (within the lined area of Cell 1)  
4 to evaluate compaction methods and performance on the sideslope.

5  
6 So that the test pad will accurately represent the performance of the full-scale facility,  
7 the following guidelines will be followed:

8  
9 Construction of the test pad will use the same soil materials, design  
10 specifications, equipment, and procedures as proposed for the full-scale  
11 facility.

12  
13 The test pad will be constructed at least four times wider than the widest piece  
14 of construction equipment to be used for the full-scale facility or 40 feet  
15 minimum (whichever is greater). This is required to ensure a sufficient  
16 representative area for testing, avoiding the edges of the test pad. The test pad  
17 may be subdivided into “lanes” to facilitate evaluation of different compaction  
18 methods; however, the width of any individual lane shall be no less than twice  
19 the width of the widest piece of construction equipment.

20  
21 The test pad will be long enough to allow construction equipment to achieve  
22 normal operating speed before reaching the area that will be used for testing  
23 or 80 feet minimum (whichever is greater).

24  
25 The test pad will be constructed with at least six lifts to evaluate the  
26 methodology used to tie lifts together. Lift thickness will be as described in  
27 Article SOIL BENTONITE PLACEMENT AND COMPACTION, and the  
28 total thickness of the test pad will be at least 3 feet.

29  
30 Horizontal Test Pad Construction:

31  
32 The test pad will be constructed on a horizontal surface (within the lined area of  
33 Cell 1) to evaluate compaction methods and verify the SBL hydraulic conductivity  
34 results of the Phase 1 test pad.

35  
36 So that the test pad will accurately represent the performance of the full-scale facility,  
37 the following guidelines will be followed:

38  
39 Construction of the test pad will use the same soil materials, design  
40 specifications, equipment, and procedures as proposed for the full-scale  
41 facility.

42  
43 The test pad will be constructed at least four times wider than the widest piece  
44 of construction equipment to be used for the full-scale facility or 40 feet  
45 minimum (whichever is greater). This is required to ensure a sufficient

representative area for testing, avoiding the edges of the test pad. The test pad may be subdivided into “lanes” to facilitate evaluation of different compaction methods; however, the width of any individual lane shall be no less than twice the width of the widest piece of construction equipment.

The test pad will be long enough to allow construction equipment to achieve normal operating speed before reaching the area that will be used for testing or 80 feet minimum (whichever is greater).

The test pad will be constructed with at least six lifts to evaluate the methodology used to tie lifts together. Lift thickness will be as described in Article SOIL BENTONITE PLACEMENT AND COMPACTION, and the total thickness of the test pad will be at least 3 feet.

Demonstrate the Following During Test Pad Construction:

Soil bentonite mixing process prior to compaction.

Compaction equipment type, configuration and weight.

The method used to break down clods before compaction and maximum resulting clod size.

The speed of compaction equipment travelling over the test pad.

Moisture content of soil bentonite at time of compaction.

Lift thicknesses (compacted), compaction procedures, and number of passes for proposed compaction equipment.

Dry unit weight achieved and measured by field density testing.

Hydraulic conductivity of compacted test fill on undisturbed samples (Shelby Tubes) as described in the Construction Quality Assurance (CQA) Plan (DOE/ID-10851).

Field permeability of compacted test fill using ASTM D6391 (horizontal test pad only) as described in the CQA Plan.

Testing shall be as described in the CQA Plan (DOE/ID-10851).

After all testing has been completed and approved, the material in the test pad can be used by the Construction Subcontractor for liner construction provided that the material satisfies the requirements of these Specifications.



1 SUBGRADE PREPARATION:

2  
3 General Requirements: The surface of the subgrade shall be graded to lines, grades, and  
4 tolerances shown on the Drawings. The subgrade surface shall be rolled flat and shall be  
5 smooth and free of ruts. Soil bentonite liner shall not be placed on frozen subgrade soils.  
6

7 Compaction: Per Section 02319, SUBGRADE PREPARATION.  
8

9 BASE SOIL PLACEMENT AND COMPACTION:

10  
11 Lift Thickness: Base soil, where shown on the Drawings, shall be placed in loose lifts and  
12 compacted such that the compacted lift thickness is 6 inches or less. However, the first lift of  
13 base soil placed over subgrade soils may be placed and compacted to a maximum thickness  
14 of 8 inches or less.  
15

16 Placement methods shall prevent excessive mixing of base soil with subgrade soil.  
17

18 Compaction: Compact each lift to at least 90 percent relative compaction at a moisture  
19 content from 2 percent dry of optimum moisture content to 3 percent wet of optimum  
20 moisture content. The Construction Subcontractor is responsible to develop and use  
21 compaction methods that produce the required relative compaction.  
22

23 Surface finishing and maintenance requirements specified for soil bentonite liner shall also  
24 apply to base soil.  
25

26 SOIL BENTONITE LINER PLACEMENT AND COMPACTION:

27  
28 Lift Thickness: Soil bentonite liner material, as specified in Article ADMIX LINER  
29 MATERIAL, shall be placed in loose lifts and compacted such that the compacted lift  
30 thickness is 6 inches or less. However, the first lift of soil bentonite liner placed over  
31 subgrade soils may be placed and compacted to a maximum thickness of 8 inches or less.  
32

33 Placement methods shall prevent excessive mixing of soil bentonite liner with subgrade soil.  
34

35 Compaction: The intent of this Specification is that soil bentonite liner shall be produced to  
36 meet an in-place performance specification of less than  $1 \times 10^{-7}$  cm/sec hydraulic conductivity.  
37 The Construction Subcontractor is responsible to develop and use compaction methods that  
38 produce the required relative compaction.  
39

40 The moisture-density range of the compacted admix shall lie within a trapezoidal-shaped  
41 field with the following corners:  
42

<u>Moisture Content (%)</u>	<u>Dry Density (pcf)</u>
-----------------------------	--------------------------

16	108
16	118
19	104
19	114

Hydraulic Conductivity: The in-place compacted soil bentonite liner shall achieve a saturated hydraulic conductivity as listed below:

All field (in-situ) test results shall be  $1 \times 10^{-7}$  cm/sec or less.

Hydraulic conductivity will be verified on undisturbed samples from completed areas of the liner as described in the CQA Plan (DOE-1D-10851). Laboratory test results on undisturbed samples shall be  $5 \times 10^{-8}$  cm/sec or less.

Uniformity: The compacted soil distribution and gradation throughout the liner shall be free from lenses, pockets, streaks, layers, or material differing substantially in texture, moisture content, dry density, or gradation from surrounding material. The soil bentonite liner material shall be free of organic debris, frozen material, rubbish, construction debris, and other deleterious material. Any soil containing unacceptable material shall be removed and discarded in the permanent stockpile, placed in accordance with Section 02315, FILL AND BACKFILL.

Moisture Conditioning: The moisture content of the soil bentonite liner shall be uniform throughout each lift prior to and during compaction of the material. If the moisture content of a lift of compacted soil bentonite liner falls below the acceptable limit during placement operations, the Construction Subcontractor shall moisture condition the dry soil and re-compact the lift prior to placement of additional lifts. If the moisture content of a lift of compacted soil exceeds the acceptable limit due to precipitation or over watering, the Construction Subcontractor, before placement of additional lifts, shall either allow the wet soil to dry back or remove the wet soil. If the soil bentonite liner material cannot be conditioned to meet the placement specifications, the material shall be removed and replaced with new soil bentonite liner.

When soil bentonite liner placement will be interrupted for more than a few hours or when precipitation is imminent, as determined by the Subcontractor's Construction Manager, the lift surface shall be sealed with a smooth drum roller to prevent excessive moisture infiltration. This surface shall be scarified with a rotovator, or other equivalent equipment, immediately prior to resuming soil placement. The Construction Subcontractor shall verify that existing moisture content is within the range specified in Article SOIL BENTONITE LINER PLACEMENT AND COMPACTION, prior to resumption of soil placement activities.

Placement Equipment: The Construction Subcontractor shall place layers of the soil bentonite liner to form a continuous monolithic material. All soil bentonite liner shall be placed and compacted with a self-propelled pegfoot or padfoot roller compactor having a minimum operating weight of 68,000 pounds. Compaction equipment with a minimum operating weight of 40,000 pounds may be used in limited areas where smaller equipment is necessary provided the required moisture and density parameters can be achieved. Hydraulic conductivity performance specification for the soil bentonite liner will be verified in areas where the lighter equipment is used. Hauling and spreading equipment will not be considered as compaction equipment. The compactor feet shall be sufficiently long to knead (bond) new lifts into previously placed lifts. The feet shall be kept free of large amounts of dried soil that might restrict foot penetration or become incorporated into the soil lift. The top of each lift may be scarified with a rotovator, or other equivalent equipment or procedures, prior to placing the subsequent lift. The final lift of soil bentonite liner may be compacted with a smooth drum roller provided that all other requirements are met.

Provide a smooth soil surface on the final lift prior to placement of the HDPE geomembrane as specified in Article SURFACE FINISHING.

Tie-in Areas: Where new soil bentonite liner is tied in to existing soil bentonite of a previous day's placement, any areas of the existing soil bentonite which are soft, cracked, or otherwise unsuitable shall be removed until acceptable material is exposed. Where new soil bentonite will be placed, the surface of the existing soil bentonite liner shall be scarified and moisture conditioned as described in this section. New soil bentonite liner shall be placed in accordance with the requirements of this section and shall be thoroughly kneaded into the existing soil bentonite liner to form a monolithic mass free of seams or other discontinuities.

Placement Method: Soil bentonite liner may be placed on the side slopes in either horizontal lifts (along the contour) or in lifts parallel to the slope (up and down the slope). If soil bentonite liner is placed parallel to the slope, compaction equipment shall not spin their wheels or in any other way disturb the previously placed lifts. If this occurs, the Construction Subcontractor shall place all of the soil bentonite liner in horizontal lifts.

Restrictions: Production, mixing, and stockpiling of admix or native clay soil shall be restricted to the area shown on the Drawings or within the Cell 1 footprint as approved by the BBWI Construction Manager.

#### SURFACE FINISHING:

The surface of the soil bentonite liner shall be trimmed to the design grades and tolerances as shown on the Drawings. The surface of the soil bentonite liner shall be rolled with a smooth-drum roller to remove all ridges and surface irregularities as specified in Section 02319, SUBGRADE PREPARATION. All wheel ruts in excess of depths specified in Section 02319, SUBGRADE PREPARATION, on the surface of the soil bentonite liner shall be repaired by the Construction Subcontractor prior to placement of the geomembrane.

1 Acceptable methods for repair of the soil bentonite liner are specified in Article REPAIR OF  
2 ADMIX LINER.

3  
4 MAINTENANCE:

5  
6 The Construction Subcontractor shall maintain the soil bentonite liner surface in a condition  
7 suitable for geomembrane installation until the surface is covered. The soil bentonite liner  
8 shall be protected from desiccation or excessive moisture. This may be accomplished by  
9 periodic watering, exclusion of traffic, placement of a temporary removable plastic cover, or  
10 other methods. Desiccation cracks larger than 1 inch deep or 0.25 inch wide shall be  
11 excavated to the full depth of the crack and repaired as specified in Article REPAIR OF  
12 ADMIX LINER. In the event that the geomembrane cannot be installed within 12 hours after  
13 placement of the final soil bentonite liner lift, the final lift of soil bentonite liner shall be  
14 constructed 4 to 6 inches thicker than required and cut to finish grade immediately before  
15 geomembrane deployment.

16  
17 The Construction Subcontractor shall take measures to prevent the soil bentonite liner from  
18 freezing. Lifts of soil bentonite liner shall not be placed on frozen surfaces. Geomembrane  
19 shall not be placed on a surface which is frozen or has been frozen and thawed until directed  
20 by the BBWI Construction Manager and the CQA Certifying Officer.

21  
22 REPAIR OF ADMIX LINER:

23  
24 The Construction Subcontractor shall repair the surface of any areas identified to be out of  
25 tolerance. The size of the repair area shall be as required to remove and/or repair defective  
26 areas of the soil bentonite liner. Repair as follows:

27  
28 Remove soil that does not meet specifications.

29  
30 Scarify surface and spray with water.

31  
32 Place additional approved soil bentonite material.

33  
34 Compact soil with self-propelled pegfoot or padfoot type compactor as described  
35 above.

36  
37 Trim and roll the surface as described above to design grades and tolerances.

38  
39 Alternative methods for repair of the soil bentonite liner will be allowed if submitted by the  
40 Construction Subcontractor and approved by the BBWI Construction Manager.

41  
42 Construction Subcontractor will repair small holes (up to a maximum 6-inch diameter)  
43 resulting from sampling and other CQA activities. Such holes shall be repaired by backfilling  
44 with soil bentonite liner or powdered bentonite material in lifts of no more than 2-inch

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1 thickness and hand tamping with a steel rod or other suitable device to firmly compact each  
2 lift.

3

4 TESTING AND ACCEPTANCE:

5

6 CQA testing and criteria for soil bentonite (compacted clay) liner and base soil acceptance is  
7 provided in DOE-1D-10851.

8

9 END OF SECTION 02666

SECTION 02667--GEOSYNTHETIC CLAY LINER (GCL)

PART 1--GENERAL

REFERENCES:

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1777	Standard Test Method for Measuring Thickness of Textile Materials.
ASTM D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
ASTM D4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.
ASTM D5084	Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
ASTM D5199	Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
ASTM D5887	Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.
ASTM D5890	Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liner.
ASTM D5891	Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.
ASTM D5993	Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners.

DEPARTMENT OF ENERGY (DOE)

DOE	DOE-ID-10851, Draft Construction Quality Assurance Plan for the INEEL CERCLA Disposal Facility.
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DESCRIPTION:

The Work includes supply and installation of geosynthetic clay liners (GCLs) for the waste disposal facility and other applications as shown on the Drawings.

PART 2--PRODUCTS

GCL:

The landfill primary GCL and evaporation pond secondary GCL as shown on the Drawings shall be BENTOMAT<sup>(R)</sup> DN as manufactured by Colloid Environmental Technologies Co. (CETCO), Arlington Heights, IL. The GCL for the evaporation pond primary GCL as shown on the Drawings shall be BENTOMAT<sup>(R)</sup> ST as manufactured by Colloid Environmental Technologies Co. (CETCO), Arlington Heights, IL. GCL for the landfill and evaporation ponds shall meet the following requirements:

<u>Property</u>	<u>Requirement</u>	<u>Test Method</u>
Thickness, in., plus or minus 0.03 in., MinARV	0.25	ASTM D1777 or ASTM D5199
Bentonite Mass/Area, lb/sq ft at 0% moisture content, MinARV	0.75	ASTM D5993
Bentonite Fluid Loss, mL, MaxARV	18	ASTM D5891
Bentonite Swell Index, mL/2g, MinARV	24	ASTM D5890
Grab Strength, lb, Tested Dry, MinARV (Landfill Primary and Evaporation Pond Secondary GCL)	150	ASTM D4632
Grab Strength, lb, Tested Dry, MinARV (Evaporation Pond Primary GCL)	90	ASTM D4632
Grab Peel, lb, Tested Dry, MinARV	15	ASTM D4632
Grab Elongation, %, Tested Dry, MinARV	15	ASTM D4632
Index Flux, m <sup>3</sup> /m <sup>2</sup> /sec, MaxARV • 2 psi Water Head Pressure • 5 psi Effective Confining Pressure	1x10 <sup>-8</sup>	ASTM D5887
Permeability with Water, cm/sec, MaxARV • 2 psi Water Head Pressure • 5 psi Effective Confining Pressure	5x10 <sup>-9</sup>	ASTM D5084

1  
2 Finished GCL Roll Width, Feet, MinARV 14 Linear Measurement

3  
4 Finished GCL Roll Length, Feet, MinARV 150 Linear Measurement

5  
6 The bentonite in the GCL shall be a sodium montmorillonite clay with a minimum free swell  
7 value of 20 and without chemical resistance enhancers or polymers.

8  
9 The GCL shall be manufactured so that the bentonite shall be continuously contained  
10 throughout the GCL and to support the geotextiles so that no displacement of the bentonite  
11 occurs when the material is unrolled, moved, cut, torn, or punctured. Any adhesive used shall  
12 be inert, nontoxic, and water soluble. GCL materials made without the use of adhesives shall  
13 be stabilized to contain the granular bentonite by a process such as needle-punching or  
14 stitching through the top and bottom layers of geotextile and the bentonite.

15  
16 For the landfill primary and evaporation pond secondary GCL, encapsulating geotextile  
17 materials shall be polypropylene, consisting of two nonwoven geotextile components which  
18 are needle-punched together. The nonwoven components of the GCL shall have a minimum  
19 mass per unit area of 6 ounces per square yard needle-punched geotextile.

20  
21 For the evaporation pond primary GCL, encapsulating geotextile materials shall be  
22 polypropylene, consisting of both a nonwoven and woven geotextile component which are  
23 needle-punched together. The nonwoven component of the GCL shall have a minimum mass  
24 per unit area of 6 ounces per square yard needle-punched geotextile. The woven component  
25 of the GCL shall have a minimum mass per unit area of 3.1 ounces per square yard slit film  
26 woven geotextile.

27  
28 The GCL manufacturer shall provide a quality control certification that the GCL has the  
29 properties listed on the specification sheet for each roll of GCL shipped to the project site.  
30 The quality control certificate shall be signed by a responsible party employed by the  
31 manufacturer, such as the production manager. The quality control certificate shall include:

32  
33 Roll numbers and production lot identification.

34  
35 Results of manufacturer quality control tests.

36  
37 ACCESSORY BENTONITE:

38  
39 Accessory bentonite for seaming shall be as recommended by the GCL manufacturer.  
40



1 TRANSPORTATION, HANDLING, AND STORAGE:

2  
3 Transportation of the GCL shall be the responsibility of the manufacturer, and the  
4 Construction Subcontractor. All handling on site shall be the responsibility of the  
5 Construction Subcontractor.

6  
7 Upon delivery at the site, the Construction Subcontractor shall observe the surfaces of all  
8 rolls for defects and for damage. This inspection shall be conducted without unrolling rolls  
9 unless defects or damages are found or suspected. The Construction Subcontractor will  
10 determine:

11  
12         Rolls, or portions thereof, which should be rejected and removed from the site  
13         because they have severe flaws.

14  
15         Rolls that are not properly labeled. No unlabelled rolls shall be used for any  
16         application. Unlabelled rolls shall be removed from the site and replaced at the  
17         Construction Subcontractor's expense.

18  
19 The Construction Subcontractor shall be responsible for the storage of the GCL onsite. The  
20 Construction Subcontractor shall provide storage space in a location as shown on the  
21 Drawings or as approved by the BBWI Construction Manager such that on-site transportation  
22 and handling are optimized to the extent possible. Storage space shall be protected from theft,  
23 vandalism, passage of vehicles, etc. Stored GCLs shall be protected from moisture and other  
24 damaging conditions in accordance with the manufacturer's recommendations.

25  
26 PART 3--EXECUTION

27  
28 GENERAL:

29  
30 Install GCLs at the locations, lines, and grades shown on the Drawings. All GCLs shall be  
31 installed in accordance with these Specifications.

32  
33 Materials and Work which fail to meet the requirements of these Specifications shall be  
34 removed and disposed of at the Construction Subcontractor's expense. This includes GCL  
35 rolls that are not labeled or where the label has deteriorated to the point of being illegible.

36  
37 HANDLING AND PLACEMENT:

38  
39 The Construction Subcontractor shall handle and deploy all GCLs in such a manner as to  
40 ensure that they are not damaged.

1    SUBGRADE PREPARATION—GCL:

2  
3    The Construction Subcontractor shall be responsible for prepared subgrade surface for the  
4    GCL. Prepare the underlying base soil fill surface as specified in Section 02319,  
5    SUBGRADE PREPARATION, and as approved by the GCL Installer.

6  
7    The GCL Installer shall certify in writing that the surface on which the GCL will be installed  
8    is acceptable. The certificate of acceptance shall be given by the Installer to the  
9    Subcontractor's Construction Manager prior to commencement of GCL installation in the  
10   area under consideration. The form for GCL Installer certification is provided as Supplement  
11   to this Specification. Submittal of this form only applies to soil surface underlying the GCL.  
12   In this case, GCL Installer certificate of acceptance is only required for the surface of the  
13   base soil fill on which the secondary GCL for the evaporation pond shall be installed.

14  
15   After the base soil fill surface has been accepted by the Installer, it shall be the Installer's  
16   responsibility to indicate to the Subcontractor's Construction Manager any change in the  
17   surface condition that may require repair work.

18  
19   DEPLOYMENT:

20  
21   GCL shall be deployed so that seams run up and down (not across) the slope.

22  
23   Prior to placement of cover material over the GCL and HDPE geomembrane, the moisture  
24   content of the bentonite component of the GCL shall not exceed 100 percent. GCL panels  
25   with bentonite component moisture content greater than 100 percent shall be removed and  
26   replaced at Construction Subcontractor's expense, regardless of the source of moisture,  
27   including adsorption from subgrade soil and/or condensation under the HDPE geomembrane  
28   or temporary plastic cover.

29  
30   Any wrinkles shall be removed by adjusting and smoothing the GCL after placement.

31  
32   GCL shall not be deployed during precipitation or in the presence of moisture, ponded water,  
33   snow, or in other situations that could cause premature hydration of the bentonite. Any GCL  
34   that hydrates prematurely shall be removed and replaced at the Construction Subcontractor's  
35   expense.

36  
37   The panels shall be placed to provide an overlap of 6 inches on longitudinal (edge of roll)  
38   seams, regardless of slope steepness. The panels shall be placed to provide an overlap of  
39   24 inches on transverse (end of roll) seams for slopes flatter than 6H:1V. No transverse  
40   seams shall be allowed on slopes 6H:1V and steeper.

41  
42   No more GCL shall be deployed than can be covered with geomembrane or other protective  
43   layer the same day.

1 Provide protection from wind uplift as necessary using sandbags or other method that will  
2 not damage the GCL.

3  
4 OVERLAPPING GCL PANELS:

5  
6 Overlap marks 6 inches from the panel edge shall be marked longitudinally on the GCL to  
7 assist in obtaining the proper overlap.

8  
9 Prior to lapping, remove all dirt, gravel, or other debris from the overlap area. Apply  
10 1/4 pound of sealing compound per linear foot of seam. Lap areas that have been  
11 contaminated by soil and/or sand shall receive additional bentonite sealant in the amount of  
12 1/4 pound per linear foot evenly spread across the longitudinal seam area.

13  
14 End of roll overlap on slopes less than 6H:1V shall be shingled so that the direction of flow is  
15 from the top panel onto the bottom panel. On slopes 6H:1V and steeper, the panels shall be  
16 placed with the long dimension (length) continuous from the crest to the toe and the upper  
17 end anchored in a trench with soil backfill as shown on the Drawings.

18  
19 REPAIRS:

20  
21 Remove damaged or hydrated areas of GCL using an approved cutter.

22  
23 Place a patch of GCL that extends at least 12 inches beyond the edges of the damaged area in  
24 all directions.

25  
26 Overlap areas shall conform to requirements for seams described above.

27  
28 PLACEMENT OF OVERLYING MATERIALS ON GEOSYNTHETIC CLAY LINING:

29  
30 The GCL shall be completely covered with HDPE geomembrane and protected at the end of  
31 each shift or workday. The Contractor shall be fully responsible to protect the GCL from  
32 damage, shrinkage, or prehydration and shall replace all affected materials at the Contractor's  
33 sole expense.

34  
35 To prevent premature hydration or shrinkage in hot weather, only the amount of GCL that  
36 can be anchored, inspected, repaired, and covered with HDPE geomembrane in the same day  
37 shall be installed.

38  
39 Equipment used to install the overlying materials shall not operate directly on the GCL.

40  
41 Construction Subcontractor shall use a "rub sheet" of smooth HDPE geomembrane between  
42 the GCL and textured HDPE geomembrane to prevent damage to the GCL while  
43 maneuvering the textured HDPE geomembrane into position for seaming. Construction  
44 Subcontractor shall develop method(s) of removing rub sheet that, after maneuvering  
45 textured HDPE geomembrane into place, prevents damage to toe underlying GCL.

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1  
2 Overlying materials shall be placed over the GCL and HDPE geomembrane as specified in  
3 Section 02661, GEOMEMBRANES.  
4  
5 SUPPLEMENTS:  
6  
7 The supplements listed below, following “END OF SECTION,” are a part of this  
8 Specification.  
9  
10 GCL Installer’s Certification of Subsurface Acceptability.  
11  
12 END OF SECTION 02667  
13

GCL INSTALLER'S CERTIFICATION  
OF SUBSURFACE ACCEPTABILITY

The GCL installer, \_\_\_\_\_  
for the INEEL CERCLA Disposal Facility and Evaporation Pond, hereby certify that the  
supporting prepared subgrade surfaces are acceptable for installation of the GCL, the  
undersigned having personally inspected the condition of the constructed surfaces. This  
certification is for the areas shown on Attachment or defined as follows:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

The condition of the supporting surfaces in the defined area meets or exceeds the minimum  
requirements for installation of the geomembrane.

Signed: \_\_\_\_\_  
GCL Installer

Signed: \_\_\_\_\_  
Construction Subcontractor

\_\_\_\_\_  
Date Signed

\_\_\_\_\_  
Date Signed

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1 SECTION 02772--ASPHALT CONCRETE PAVING

2  
3 PART 1--GENERAL

4  
5 WORK INCLUDED:

6  
7 Provide all work, operations, and material required to construct asphalt paving in accordance  
8 with the project drawings and these specifications.  
9

10 REFERENCES:

11  
12 The following documents, including others referenced herein, form part of this section to the  
13 extent designated herein:  
14

15 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION  
16 OFFICIALS (AASHTO)

17  
18 AASHTO Standard Specifications for Transportation Materials and Methods of  
19 Sampling and Testing.  
20

21 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

22  
23 ASTM D946 Standard Specification for Penetration Graded Asphalt Cement for use  
24 in Pavement Construction.  
25

26 IDAHO TRANSPORTATION DEPARTMENT (ITD)

27  
28 Standard Specifications for Highway Construction (SSHC)  
29 1999 Edition.

30 Field Test Manual, Part I, Sampling and Test Methods.  
31

32 PART 2--PRODUCTS

33  
34 ASPHALT BINDER:

35  
36 The asphalt cement shall be Viscosity Grade PG 58-28 in accordance with Section 702 of the  
37 SSHC and AASHTO MP-1.  
38

39 CRUSHED GRAVEL AGGREGATE:

40  
41 Aggregate for the plant mix pavement shall be in accordance with Section 703 (SSHC) for  
42 Class I mixes.  
43

1 TACK COAT:

2  
3 The tack coat shall be an emulsified asphalt, CSS-1, diluted with one part water to one part  
4 emulsified asphalt, meeting the applicable requirements of Section 702 (SSHC).

5  
6 PART 3--EXECUTION

7  
8 COMPOSITION OF MIXTURE:

9  
10 The asphalt concrete shall be composed of a mixture of aggregate, filler if required, and  
11 asphalt, and shall meet the following criteria:

12  
13 Marshall Method:

14 Stability: 500-pound minimum.

15 Flow: 8 to 20.

16 Air Voids: 3 percent to 5 percent.

17  
18 HVEEM Method:

19 Stability: 37 minimum (See 405.02 of SSHC).

20 Swell: Less than 0.030 in.

21 Air Voids: 3 percent to 5 percent.

22  
23 After the mix design is established, all mixtures furnished for the project shall conform  
24 thereto within the following ranges of tolerances:

25  
26 Passing No. 4 and Larger Sieves:  $\pm 7$  percent.

27 Passing No. 8 to No. 100 Sieves, Inclusive:  $\pm 4$  percent.

28 Passing No. 200 Sieve:  $\pm 2$  percent.

29 Asphalt:  $\pm 0.4$  percent.

30 Temperature of Mixture:  $\pm 20$  degrees F.

31  
32 Should a change in sources of material be made, a new mix design shall be established before  
33 the new material is used.

34  
35 The aggregate and asphalt shall be mixed in accordance with SSHC Section 405.11.

36  
37 SUBBASE PREPARATION:

38  
39 Excavate existing surface as specified in Section 02316, EXCAVATION, or place earthfill as  
40 specified in Section 02315, FILL AND BACKFILL, to subgrade elevations where required  
41 to permit placement of structural fill and crushed gravel base material to the depth shown on  
42 the Drawings.

43  
44 Verify that the subbase is dry and in suitable condition to support paving and imposed loads.  
45 Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or

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that require further compaction. Proceed with paving only after unsatisfactory conditions have been corrected.

#### PLACING STRUCTURAL FILL:

As specified in Section 02315, FILL AND BACKFILL.

#### PLACING CRUSHED GRAVEL BASE LEVELING COURSE:

General: Furnish and place crushed gravel base as a leveling course and as shoulder protection in accordance with the plans and specifications.

Construction Requirements: Crushed gravel shall be mixed by motor graders or other approved equipment until the mixture is uniform throughout. During the mixing, water shall be added in an amount necessary to facilitate compaction. Use watering equipment specified in this Specification.

Compaction: After each layer has been spread it shall be compacted for its full width. The choice of compaction equipment will be left to the Subcontractor. Compaction shall continue until not less than 95 percent of the maximum density is attained, determined in accordance with AASHTO T99.

#### SURFACE PREPARATION:

Existing asphalt shall be cleaned to permit adhesion of bituminous materials. The prepared base shall be kept in repair at all times in advance of placing the plant mix pavement. Holes or depressions shall be filled level with bituminous surfacing, brought to the required grade and compacted. Do not commence placing asphalt until all conditions are satisfactory.

Tack Coat: Apply to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.10 gallon per square yard of surface.

Allow to dry until the tack coat has reached the proper condition to receive paving.

#### PLACING AND FINISHING ASPHALT CONCRETE:

General: Prior to placing the mixture on the roadbed, the prepared base shall be satisfactorily cleaned of all loose and foreign material. Uniformity of temperatures of the mixture delivered to the paver shall be such that the temperature of any one load shall not vary more than 20 degrees F from the average of the preceding five loads. The material shall be placed to the specified thickness. Placing of the paving mixture shall be as continuous as possible.

Joints: Longitudinal joints shall be smooth, straight, and show no segregation of material. Should irregularities in the edge of the surface appear, the previous lane shall be cut back to a



vertical face before placing adjacent material. Any material removed in cutting back the course to a vertical face shall be removed and wasted.

Transverse joints shall be formed by cutting back on the previous run or existing asphalt to expose the full depth of the course. A brush coat of CSS-1 emulsified asphalt shall be used on contact surfaces of transverse joints, cold longitudinal joints, and existing asphalt edges just before additional mixture is placed.

Cuts shall be straight and clean.

Rolling: The asphalt concrete shall be compacted as quickly as possible after placing. Breakdown rolling shall follow the paver as closely as possible. Intermediate rolling shall follow immediately behind the breakdown rolling. Compaction of the pavement shall continue until the pavement density is 96 percent of that specified in the approved laboratory report. Testing of the plant mix density will be performed according to Idaho Department of Highways Method of Test T125 (Nuclear Densimeter). All breakdown and intermediate compaction shall be performed while the mixture temperature is above 180 degrees F. Finish rolling shall be performed at as high a temperature as practicable and shall eliminate marks from previous rolling. Finish rolling shall be done the same day as the paving. Rollers shall not pass over the unprotected end of a freshly laid mixture.

Surface Smoothness: The completed surface will be inspected in accordance with Idaho Transportation Department Division of Highways Method of Test T87. The surface shall not vary more than 1/4 inch from a 10-foot straight edge.

Weather Limitations: Plant mix material shall not be placed on a wet or frozen surface, when the air temperature is below 40 degrees F, or when weather or surface conditions otherwise prevent the proper handling or finishing of the plant mix material.

#### EQUIPMENT REQUIREMENTS:

Hauling Equipment: Trucks used for hauling plant mix materials shall have tight, clean, smooth metal beds. When necessary each truck shall have a cover of canvas or other suitable material of such size as to protect the mixture from the weather. When necessary, so that the mixture will be delivered on the road at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

Paver: Pavers shall be self-propelled units, provided with an activated heated screed. Only screed extensions that produce results equal to the rest of the screed will be allowed.

The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.

1 The paver shall be operated at a speed consistent with the delivery of plant mix which  
2 provides for a smooth, uniform forward travel with the least stops.

3  
4 The screed shall be equipped with automatic controls which will make adjustments in both  
5 transverse and longitudinal directions. The sensing device shall pick up grade information  
6 from a ski that is a minimum of 30 feet in length. The ski may be removed when paver is  
7 required to operate in areas of limited space (parking areas, turnarounds, fillets, etc.,). In the  
8 event of failure of the automatic controls, the Subcontractor will be permitted to finish the  
9 day's run using manual controls, but he will not be permitted to resume operations until the  
10 controls are repaired.

11  
12 Rollers: Nonvibrating steel-wheel rollers shall be multiple axle, self-propelled, equipped with  
13 cleaning devices and weighing from 8 to 12 tons. Pneumatic-tire rollers shall be self-  
14 propelled and constructed within the limits of 50 to 100 percent of the values set in groups  
15 No. 2, 3, and 4 as set forth in Section 306 (SSHC). Rollers shall be equipped with a means of  
16 distributing the load uniformly between all wheels on at least one of the axles. The use of  
17 wobble-wheel rollers whose tires revolve in a plane that is not at right angles to the axle shaft  
18 will not be permitted. Rollers shall be multiple axle, multiple wheel type with wheels  
19 staggered on the axles and spaced so that the overlap of wheels will provide for uniform  
20 compaction for the full compacting width of roller. The air pressure in any tire shall not vary  
21 more than 5 pounds from the pressure established. The rollers shall be operated at speeds of  
22 not less than 3 nor more than 8 miles per hour.

23  
24 Scales: DOE-owned scales located in the Central Facilities Area may be used at no cost to  
25 the Construction Subcontractor, or the Construction Subcontractor may furnish his own  
26 scales. Scales shall meet the applicable portions of Section 109.01 (SSHC).

27  
28 Watering Equipment: Provide water tank trucks capable of applying a uniform unbroken  
29 spread of water over the surface. A suitable device for positive shut-off and regulation of  
30 flow shall be located to permit operation by driver in cab.

31  
32 END OF SECTION 02772

SECTION 02920--RECLAMATION AND REVEGETATION

PART 1--GENERAL

SUMMARY:

Section includes, but is not limited to preparing seedbeds, sowing grasses, applying fertilizer, and applying mulch to revegetate disturbed sites.

REFERENCES:

DEPARTMENT OF ENERGY (DOE)

DOE-ID-12114 Guidelines for Vegetation of Disturbed Sites at the INEEL

PART 2--PRODUCTS

MATERIALS:

Topsoil: Clean topsoil free from any toxic minerals, noxious weeds or other objectionable material. Topsoil shall be obtained from existing temporary stockpile at the ICDF site or from stripping of the borrow area as specified in Section 02317, BORROW AREA EXCAVATION.

Grass Mix: The following grass mix shall be used for all permanent embankments, slopes, and drainage ways.

The following seed mixture shall be used:

<u>Species</u>	<u>Pounds Per Acre Pure Live Seed</u>
Secar Bluebunch Wheatgrass	3
Bottlebrush Squirreltail	2
Sandberg Bluegrass	2
Sodar Streambank Wheatgrass	3
Green Rabbitbrush	0.25
Total	10.25

For the seed mixture specified, the maximum allowable noxious weed percentage (by weight) is 0.5 percent. The maximum allowable inert and other crop percentage is 7.0 percent.

Fertilizer: Fertilizer shall be 16-48-0 (NPK) ammonium or diammonium phosphate. Each component of the fertilizer may vary two percent.

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Mulch: Mulch shall be processed straw free from noxious weeds and other deleterious materials based on a visual observation.

#### EQUIPMENT:

Seedbed Preparation: Disks, harrows, roller harrow-packers (culti-packers), tooth type harrows, shovels, crimper, or other similar equipment.

Seeding and Fertilizing: Drills with double disc and agitator, ground driller hand seeder, culti-packer with seed boxes, Brillion seeder, or other similar equipment.

### PART 3--EXECUTION

#### GENERAL:

Reclamation and revegetation shall be performed in accordance with the guidelines specified in DOE-ID-12114 and these specifications.

Season of Work: Seeding shall be done between October 10 and November 30. Specific ideal seeding times within these windows shall be as required for proper seedbed preparation.

Weed Control: Areas to be seeded shall be maintained reasonably free of weeds. Weeds shall be kept from going to seed.

Seedbed Preparation: Soil shall be tilled a minimum depth of 6 inches. A minimum of 6 inches of topsoil shall be tilled into the seedbed. The seedbed shall be firm below seeding depth and well pulverized and loose on top. It shall be free of clods and weeds. Seedbed preparation shall not be performed when soil conditions are not suitable for tilling: too dry, too wet, frozen, etc. Tillage shall produce cross-slope furrows on slopes.

On areas subject to severe erosion, the extent of seedbed preparation shall not exceed that which can be seeded in one day.

Fertilizing: Fertilizing shall closely follow seedbed preparation. Fertilizer shall not be mixed with seed. Fertilizer may be drilled or broadcast. Fertilizer shall be applied at a rate of 150 pounds per acre.

Seeding: Seeding shall closely follow fertilizing. If the seedbed has been disturbed, then the Subcontractor shall prepare the seedbed again. Seeding work shall not proceed until the seedbed has been inspected by the CQA Certifying Officer. Seeds shall be thoroughly mixed prior to application. Seeds shall be uniformly applied at the previously specified rate. Seeds shall be buried 0.25 to 0.75 inch. Seeding shall not be performed when weather conditions are unfavorable: high wind, heavy rain, etc.

Drilling shall maintain cross-slope furrows on slopes.

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- 1
- 2 Mulching: Mulch shall be spread uniformly at a rate of 1 ton per acre. Mulch shall be
- 3 anchored into the soil to a depth of at least 2 inches and with no more than one pass of the
- 4 equipment. Mulching shall not be performed when wind interferes with mulch placement.
- 5
- 6 Protection: Traffic over seeded area shall be prohibited.
- 7
- 8 END OF SECTION 02920